

# **Final Third Five-Year Review Report**

**Luke Air Force Base, Arizona**



**Submitted to:**



**U.S. Army Corps of Engineers  
Fort Worth District**

**Contract No.: W9126G-06-D-0037  
Task Order No.: 0028**

**Submitted By:**



**Stell Environmental Enterprises, Inc.  
25 East Main Street  
Elverson, PA 19520**



**ARCADIS US, Inc.  
4646 East Van Buren, Suite 400  
Phoenix, AZ 85008**

**July 2012**

## SIGNATURE SHEET

Signature sheet for the Third Five-Year Review of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions at Luke Air Force Base, Glendale, Arizona.

### Protectiveness Determination

The remedies at Operating Unit 1 (OU-1) and OU-2 sites are currently protective of human health and the environment. Exposure pathways are being controlled through the implementation of institutional controls (ICs) and long-term monitoring (LTM). Because the remedial actions at the OU1 and OU-2 sites are protective, the site is protective of human health and the environment.

Approved by:

Date:



ROBERT E. WEBB, Colonel, USAF  
Vice Commander, 56<sup>th</sup> Fighter Wing

21 Sep 12

See attached concurrence letter.

MICHAEL M. MONTGOMERY  
Assistant Director  
Federal Facilities and Site Cleanup Branch, Region 9  
United States Environmental Protection Agency

TINA LEPAGE  
Section Manager – Remedial Projects Section  
Arizona Department of Environmental Quality

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## LIST OF ACRONYMS

1,1,2,2-PCA	1,1,2,2-Tetrachloroethane
1,1-DCE	1,1-Dichloroethene
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AFB	Air Force Base
AGE	Above Ground Equipment
amsl	above mean sea level
ARARs	Applicable or Relevant and Appropriate Requirements
AWQS	Arizona Water Quality Standards
BGP	Base General Plan
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAB	Community Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminants of Concern
cpm	counts per minute
DEHP	Diethylphthalate
DRMO	Defense Reutilization and Marketing Office
FFA	Federal Facilities Agreement
FTP	Fire Training Pits
HDPE	High Density Polyethylene
HHRA	Human Health Risk Assessment
ICs	Institutional Controls
ICP	Institutional Control Plan
IRP	Installation Restoration Program
LTM	Long-Term Monitoring
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
OU	Operable Unit
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
POL	Petroleum, Oils, and Lubricants

PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
PSC	Potential Sources of Contamination
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RSLs	Regional Screening Levels
SEE	Stell Environmental Enterprises
SRL	Soil Remediation Level
SVE	Soil Vapor Extraction
SVOCs	Semivolatile Organic Compounds
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
ug/L	micrograms per liter
uR/hr	microRoentgen per hour
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VEMUR	Voluntary Environmental Mitigation Use Restriction
VOCs	Volatile Organic Compounds
WQS	Water Quality Standards
WRRB	Work Request Review Board
WWTP	Wastewater Treatment Plant

## EXECUTIVE SUMMARY

The remedies implemented at ten sites identified in the Operating Unit 1 (OU-1) and OU-2 Records of Decision (RODs) at Luke Air Force Base (AFB) in Glendale, Arizona included soil treatment, source capping, groundwater monitoring, gamma radiation monitoring, and institutional controls (ICs). The ICs consisted of Voluntary Environmental Mitigation Use Restrictions (VEMURs) or internal land use restrictions. The trigger for this third five-year review was the completion of the second five-year review in June 2007.

This third five-year review report discusses the following ten sites that required a remedy, as determined from the results of the remedial investigation (RI):

- Drainage Ditch Disposal Area (DP-13)
- Eastern Portion of North Fire Training Area (FT-07E)
- Outboard Runway Landfill (LF-03)
- Old Salvage Yard Burial Site (LF-14)
- Northwest Landfill (LF-25)
- Wastewater Treatment Annex Landfill (RW-02)
- Oil/Water Separator at Auto Body Shop (SD-38)
- Bulk Fuels Storage Area (SS-42)
- Former Liquid Waste Storage Facility (Facility 993) (ST-18)
- Old Surface Impoundment West of Facility 993 (DP-23)

The assessment conducted as part of this five-year review found that the remedies required at the OU-1 and OU-2 sites were implemented in accordance with the requirements of the RODs. All remedies are functioning as designed, continue to be protective of human health and the environment, and control exposure pathways that could result in unacceptable risks.

## FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site name (from WasteLAN): Luke Air Force Base		
EPA ID (from WasteLAN): AZ0570024133		
Region: 9	State: AZ	City/County: Glendale/Maricopa
SITE STATUS		
NPL status: Final <u>Deleted</u> Other (specify)		
Remediation status (choose all that apply): Under Construction Operating <u>Complete</u>		
Multiple OUs? <u>YES</u> NO	Construction completion date: 09/25/2000	
Has site been put into reuse? YES <u>NO</u>		
REVIEW STATUS		
Lead agency: USEPA State Tribe <u>Other Federal Agency</u> Luke Air Force Base		
Author name: Marla Miller		
Author title: Senior Environmental Engineer	Author affiliation: ARCADIS / Luke AFB Contractor	
Review period**: June 2007 through December 2011		
Date(s) of site inspection: September 2011		
Type of review: <div style="display: flex; justify-content: space-around;"> <span><u>Post-SARA</u></span> <span>Pre-SARA</span> <span>NPL-Removal only</span> </div> <div style="display: flex; justify-content: space-around;"> <span>Non-NPL Remedial Action Site</span> <span>NPL State/Tribe-lead</span> </div> <div style="display: flex; justify-content: space-around;"> <span>Regional Discretion</span> </div>		
Review number: 1 (first) 2 (second) <u>3 (third)</u> Other (specify) _____		
Triggering action: Actual RA Onsite Construction at OU # _____ Construction Completion Other (specify) _____ <div style="text-align: right;"> <u>Actual RA Start at OU#</u>  <u>Previous Five-Year Review Report</u> </div>		
Triggering action date (from WasteLAN): 06 / 22 / 2007		
Due date (five years after triggering action date): 06 / 22 / 2012		

\* ["OU" refers to operable unit.]

\*\* [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

## **Five-Year Review Summary Form, cont'd.**

### **Issues:**

- Rising groundwater levels
- Condition of the concrete cap at ST-18
- Determination of gamma radiation action level
- ICP and BGP require updating

### **Recommendations and Follow-up Actions:**

- Continue to annually monitor groundwater at ST-18 and SS-42
- Continue to perform repairs to ST-18 concrete cap when required
- Work with ADEQ to assess the appropriateness of calculating action level as twice the background gamma radiation level
- Update ICP and BGP

### **Protectiveness Statement(s):**

The remedies at the OU-1 and OU-2 sites are protective of human health and the environment. Exposure pathways are being controlled through the implementation of ICs and LTM.

### **Other Comments:**

None

## 1.0 INTRODUCTION

This third five-year review report was prepared by Stell Environmental Enterprises (SEE) and ARCADIS-U.S., Inc. (ARCADIS) for Luke Air Force Base (AFB) under Contract No. W9126G-06-D-0037, Task Order 0028. The purpose of the five-year review is to assess whether remedial actions, as described in the Record of Decision (ROD), continue to be protective of human health and the environment. The five-year review process is required because contaminants identified during Basewide investigations are present above levels that allow for unlimited use and unrestricted exposure. The five-year review report documents the data review and site inspections, identifies issues found during the review process, and provides recommendations to address issues.

Luke AFB, with assistance from SEE and ARCADIS, conducted the third five-year review of the remedial actions implemented at the Operable Unit 1 (OU-1) and OU-2 sites at the Base. This review process was led by Mr. Alan Thomas, the Luke AFB Restoration Program Manager, and consisted of site inspections, interviews, and a review of relevant documents and data. The site inspection forms completed for each site are included in Appendix A. The interview records are provided in Appendix B.

Five-year reviews have been conducted at Luke AFB and reported in the *Final First Five-Year Review* (ARCADIS, 2002) and *Final Second Five-Year Review Report for Luke Air Force Base* (HGL, 2007). The trigger for the initiation of this third five-year review report was the completion of the second five-year review on June 22, 2007. At the time, the Arizona Department of Environmental Quality (ADEQ) and the United States Environmental Protection Agency (USEPA) reviewed the second five-year review report, and concurred that the remedies implemented at Luke AFB were protective of human health and the environment under the current land use. The review also concluded that exposure pathways that could result in unacceptable risks were being controlled through the implementation of institutional controls (ICs) and long-term monitoring (LTM).

SEE and ARCADIS prepared this third five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities*

*for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The USEPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*



## 2.0 BACKGROUND

The USEPA placed Luke AFB on the National Priorities List (NPL) on August 30, 1990. In September 1990, the USEPA, ADEQ, the Arizona Department of Water Resources (ADWR), and the United States Air Force (USAF) signed a Federal Facilities Agreement (FFA) to establish the procedural framework for conducting the required environmental investigations at Luke AFB. Subsequent environmental investigations at Luke AFB were implemented in accordance with regulations established in the NCP.

Based on the information compiled during the initial planning stages, the FFA identified 33 potential sources of contamination (PSC) at the Base. To aid in the management of the investigations, the FFA parties divided the PSCs into OU-1 and OU-2. OU-1 included the investigation of soils at 25 PSCs and the Basewide investigation of air, surface water, and groundwater resources. OU-2 included the investigation of soils at eight PSCs where only petroleum-related wastes were potentially disposed.

Of the 25 sites investigated at OU-1, eight sites were determined to require further action. For the eight sites investigated at OU-2, only two sites were determined to warrant remedial action. Remedial alternatives were developed for the ten sites determined to warrant remediation and were documented in the OU-1 and OU-2 RODs. The remedies implemented for these ten sites consisted of soil treatment, source capping, groundwater monitoring, gamma radiation monitoring, and ICs. ICs consisted of Voluntary Environmental Mitigation Use Restrictions (VEMURs) or internal land-use restrictions.

The ROD for OU-1 was signed in May 1999 and the ROD for OU-2 was signed in January 1994. Based on the instituted remedies listed in the RODs, the USEPA delisted Luke AFB from the NPL on April 22, 2002.

This third five-year review report discusses the ten sites that required a remedy, as determined from the results of the RI:

- Drainage Ditch Disposal Area (DP-13)
- Eastern Portion of North Fire Training Area (FT-07E)
- Outboard Runway Landfill (LF-03)
- Old Salvage Yard Burial Site (LF-14)
- Northwest Landfill (LF-25)
- Wastewater Treatment Annex Landfill (RW-02)
- Oil/Water Separator at Auto Body Shop (SD-38)
- Bulk Fuels Storage Area (SS-42)
- Former Liquid Waste Storage Facility (Facility 993) (ST-18)
- Old Surface Impoundment West of Facility 993 (DP-23)

The sites classified as No Further Action sites in their respective RODs were not evaluated. However, during the first five-year review, ADEQ requested that several wells be added to the long-term monitoring (LTM) program. In response to this ADEQ comment, Luke AFB added additional monitoring wells at sites FT-07E, RW-02, and SD-20 to the LTM program. Site SD-20 was considered a No Further Action site in the OU-1 ROD; however, because it was added to the LTM program by ADEQ, it is also discussed in this report.

## **2.1 Installation Description**

Luke AFB is situated on approximately 4,000 acres west of the Phoenix metropolitan area in Glendale, Arizona (Figure 1). The Base was annexed by the City of Glendale in 1995. The operational; portion of the Base, located west of Litchfield Road, includes two runways; aircraft operation, training, and maintenance facilities; operational support facilities; and a variety of administrative offices and dormitories. The community portion of the Base, located east of Litchfield Road, includes military family housing; the Base Exchange and Commissary complex; medical facilities; recreational areas and other community-support facilities. The Base facility map showing PSC locations is presented in Figure 2.

Aircraft maintenance and light industrial operations in support of training missions have been in existence at Luke AFB since its inception in 1941. The results of these activities generated potentially hazardous wastes, including petroleum residues and degreasing solvents (ARCADIS, 2002).

## **2.2 Physiography/Geology**

Luke AFB is generally flat with a gentle slope from the north to south. The elevation of the Base ranges from 1,075 to 1,105 feet above mean sea level (amsl) (Luke AFB, 2002). Luke AFB is located in the Basin and Range Physiographic province, which is characterized by mountains that extend in a northwest-southeast direction. The mountain ranges are separated by broad, alluvial valleys. Luke AFB is located in a basin approximately six miles east of the White Tank Mountains in the Lower Colorado River Valley Subdivision of the Sonoran Desert. Gravel-sized fragments of metamorphic gneiss and igneous granite have been found at Luke AFB. The fragments are randomly dispersed in the soil matrix, which consists of loam or mixtures of sand, silt, and clay. The soils at Luke AFB are underlain by alluvial and basin fill consisting of sand, silt, gravel, clay, and salt, which are approximately 10,000 feet thick (HGL, 2007).

## 2.3 Hydrology

The hydrology information is summarized from the *Final First Five-Year Review* (ARCADIS, 2002). Groundwater levels declined more than 300 feet in the vicinity of Luke AFB from 1923 to the late 1970s, primarily because of significant overdraft in response to pumping for irrigation requirements. The greatest declines occurred west, north, and south of Luke AFB. A large cone of depression has existed southwest of the Luke AFB since sometime before 1964. The regional groundwater flow direction, which is modified by the cone of depression, is to the south-southwest.

Data from selected wells suggest that water levels have declined substantially over most of the area through at least 1980. After 1980, many of the water level measurements show a leveling off of the decline trend, or a groundwater rise of up to 40 to 60 feet. Since the early 1980s, groundwater elevations in the area have continued to rise due to reduction in pumping and increased recharge. Elevations have continued to increase at rates up to 5 feet per year. As of 2011, the Base groundwater level was approximately 240 feet below ground surface (bgs). The availability of Colorado River water via the Central Arizona Project canal (especially for agricultural irrigation) has greatly lessened the demands placed on groundwater in the Phoenix area and has resulted in the groundwater table rising throughout much of the area.

## 2.4 OU-1 and OU-2 Sites

Twenty-five PSCs at OU-1 were investigated during the RI. Results indicated that the air, surface water, and groundwater resources at these sites did not pose an imminent or substantial endangerment to public health, welfare, or the environment. However, the soils at eight of the sites were found to have conditions that could impact the underlying groundwater or cause unacceptable human health risks under certain land use scenarios. Remedial actions were developed for soils at the following OU-1 sites listed in Table 1.

<b>Table 1</b>	
<b>OU-1 Sites with Remedial Actions</b>	
<b>PSC ID</b>	<b>Description</b>
DP-13	Drainage Ditch Disposal Area
FT-07E	Eastern Portion of North Fire Training Area
LF-03	Outboard Runway Landfill
LF-14	Old Salvage Yard Burial Site
LF-25	Northwest Landfill
RW-02	Wastewater Treatment Annex Landfill
SD-20*	Oil/Water Separator Canal and Earth Fissure
SD-38	Oil/Water Separator at Auto Body Shop
SS-42	Bulk Fuels Storage Area

Notes: \* SD-20 did not require remedial action per the ROD, however, this site was added to the LTM at ADEQ's request after the first five-year review

Eight PSCs at OU-2, associated with petroleum-related wastes, were investigated during the RI. Results indicated that the air, surface water, and groundwater resources at six of the sites did not pose an imminent or substantial endangerment to public health, welfare, or the environment. Remedial alternatives developed for the remaining two OU-2 sites are listed in Table 2.

<b>Table 2</b>	
<b>OU-2 Sites with Remedial Actions</b>	
<b>PSC ID</b>	<b>Description</b>
DP-23	Old Surface Impoundment West of Facility 993
ST-18	Former Liquid Waste Storage Facility (Facility 993)

### 3.0 SITE HISTORY AND INITIAL RESPONSE ACTIONS

This section describes the history of contamination and initial response actions for the eleven PSCs addressed in this review. Initial responses were considered to be significant activities completed before the RODs were signed. The following information was primarily derived from the OU-1 and OU-2 RODs (Geraghty & Miller, 1994 and ARCADIS, 1999), the *Final Remedial Investigation Report* (Geraghty & Miller, 1997), the *First Five-Year Report* (ARCADIS, 2002), and the *Second Five-Year Review Report* (HGL, 2007).

#### 3.1 DP-13: Drainage Ditch Disposal Area

**History of Contamination:** Site DP-13 is located in the northwest corner of the Base (Figure 3). During the 1940s, this site was the location of a drainage ditch which was reportedly used for general refuse disposal. The ditch was filled and covered when the Base was deactivated in 1946. Asphalt and concrete rubble stored in the northwest corner of the site was disposed in a burial pit in 1974. No known or suspected industrial-type wastes or hazardous wastes were disposed at this site. Currently, a majority of the site is undeveloped. The northern portion of the site is used for military deployment preparedness training, simulating field encampment conditions.

**Initial Response Actions:** During the OU-1 RI, geophysical and soil gas surveys were conducted to define the landfill boundaries and select locations for test pits. Fifteen test pits were excavated to characterize the extent and contents of the landfill. Ten soil borings were also advanced to further delineate the vertical and lateral extent of contamination detected in the test pit samples. In August 1996, three additional soil borings were advanced to collect supplemental volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) data for risk assessment purposes.

The test pit located near the side of a maintained road within the bivouac area intercepted an inactive underground utility line. A paint pail and dried paint residue were also observed in the test pit. Samples collected from that test pit at a depth of 5 feet bgs contained chromium at 15,900 milligrams per kilogram (mg/kg) and lead at 36,000 mg/kg. These values exceeded residential screening levels. Because the wastes are buried and the surface area is maintained, direct exposure is not likely under current land use scenarios. However, exposure to these buried wastes could result if excavations were to occur at certain areas of the site, or if the site were developed for residential purposes; therefore, remedial alternatives were developed for DP-13 as a protective measure. Table 3 summarizes the past activities and environmental investigations at DP-13.

<b>Table 3</b> <b>Chronology of Events at DP-13: Drainage Ditch Disposal Area</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
1940s	Site was the location of a drainage ditch reportedly used for non-hazardous refuse disposal. The site was filled and covered in 1946.
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
1992/1994; August 1996	Multi-phase RI conducted throughout OU-1. Investigation determined boundaries of the former landfill and characterized its contents. Chromium and lead were detected at depth; also analyzed for VOCs and SVOCs for risk assessment purposes.
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
June 15, 2000	VEMUR filed with county recorder
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
October 5, 2005	Site inspection completed
June 2007	Second Five-Year Review completed
September 1, 2011	Site inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due

### 3.2 FT-07E: Eastern Portion of North Fire Training Area

**History of Contamination:** FT-07E is situated in the northern portion of Luke AFB, west of the Fire Department Training Facility 1355 (Figure 4). Fire training activities in the eastern portion of FT-07E began in 1973 when the Base constructed three fire-training pits (FTPs). According to Luke AFB records, the three FTPs were active from 1973 until 1989. The two largest FTPs, FTP-3 and FTP-4, were constructed with sprinkler systems to dispense off-specification petroleum, oils and lubricants (POL) onto mock aircraft or similar structures. During training exercises, fires were extinguished with water.

**Initial Response Actions:** Four soil borings were advanced and three monitoring wells were installed at FT-07E to assess potential impacts for fire training activities. Three additional soil borings were advanced in each of the FTPs. Based on the results of these investigations, the Base operated a soil vapor extraction (SVE) system at FTP-3 and FTP-4 from April 1992 through December 1992. Calculations indicate over 14,000 pounds of total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylenes (BTEX) constituents were removed from the soil and destroyed by a thermal oxidizer treatment system.

The SVE system effectively reduced TPH levels at depths greater than 16 feet bgs. Groundwater sample results provide evidence that the underlying groundwater resources have not been impacted and vadose zone transport modeling suggests that residual petroleum hydrocarbon contaminants in the soil will not leach to the underlying groundwater. However, relatively high TPH concentrations (27,000 mg/kg) remained in the soils near the surface, so remedial alternatives were developed. Table 4 summarizes the past activities and environmental investigations at FT-07E.

<b>Table 4</b>	
<b>Chronology of Events at FT-07E: Eastern Portion of North Fire Training Area</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
1973 to 1989	Site was used for fire training and consisted of three pits (FTP-3, FTP-4, and FTP-6). Sprinkler systems dispensed petroleum, oil, and lubricant waste onto mock airplanes in the two largest pits (FTP-3 and FTP-4).
1984 to 1988	Soil and groundwater sampling was conducted at FTP-3 and FTP-4 during the IRP investigation
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
1992	Additional soil sampling conducted at FTP-3, FTP-4, and FTP-6
January 1992	Pilot study conducted to test the effectiveness of SVE at the site
March 1992	SVE system installed at FTP-3 and FTP-4
April 1992 to December 1992	SVE system operational
1992/1994; August 1996	Multi-phase RI conducted throughout OU-1. MW-118 and MW-123 were installed at the site.
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
May 12, 2000	Groundwater LTM Plan for site submitted
June 15, 2000	VEMUR filed with county recorder
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed. Based on ADEQ recommendation, MW-118 and MW-123 added to LTM program and will be sampled at every 5-year review.

<b>Table 4 (cont.) Chronology of Events at FT-07E: Eastern Portion of North Fire Training Area</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
April 22, 2002	Luke AFB delisted from NPL
August 2006	Groundwater samples collected from MW-118 (MW-123 collapsed)
August 21, 2006	Site inspection completed
June 2007	Second Five-Year Review completed
April 2008	Monitoring well MW-123 abandoned and three new wells (MW-118-S, MW-123-S, and MW-123-D) were installed and sampled
May 2011	Groundwater samples collected from MW-118-S and MW-123-S
September 1, 2011	Site inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due

### 3.3 LF-03: Outboard Runway Landfill

**History of Contamination:** LF-03 consists of a former construction debris landfill located on the western side of the Base near the central part of the outboard runway, south of a taxiway (Figure 5). The site occupies approximately 21 acres, 60 percent of which is covered by the outboard runway. The remainder of the site consists of a bare low-lying area with sparse vegetation. The Base reportedly used the site for limited disposal of refuse from 1951 to 1953. Landfill operations at this site ceased when the outboard runway was constructed. No known or suspected industrial-type wastes or hazardous wastes were disposed at this site.

**Initial Response Actions:** During the OU-1 RI, geophysical and soil gas surveys were conducted to define the landfill boundaries and select locations for test pits. Six test pits were excavated and sampled to characterize its extent and contents. Two additional soil borings were advanced and sampled in August 1996 to collect additional VOC and SVOC data for risk assessment purposes.

Numerous metallic wastes were unearthed during test pit excavation at the central portion of the site. Samples of the wastes collected from one test pit at depths of 7 to 8 feet bgs contained chromium at a concentration of 386 mg/kg. Direct exposure is not likely under current land use scenarios because the elevated chromium concentrations are buried in the subsurface and extend below the outboard runway. However, long-term exposure to these buried wastes could result if the runways were removed and the site was developed for residential purposes; therefore, remedial alternatives were developed for LF-03. Table 5 summarizes the past activities and environmental investigations at LF-03.



<b>Table 5</b> <b>Chronology of Events at LF-03: Outboard Runway Landfill</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
1951 to 1953	Site was used for limited disposal of non-hazardous refuse
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
1992/1994; August 1996	Multi-phase RI conducted throughout OU-1
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
June 15, 2000	VEMUR filed with county recorder
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
October 5, 2005	Site inspection completed
June 2007	Second Five-Year Review completed
September 1, 2011	Site inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due

### 3.4 LF-14: Old Salvage Yard Burial Site

**History of Contamination:** LF-14 consists of a former landfill site located in the northeastern corner of the Base (Figure 6). This site was part of a main, unlined drainage canal for the north end of the Base in the 1940s. The canal was abandoned when the drainage was changed in the 1950s. The abandoned canal may have been used as a landfill and was completely filled and covered by 1962. According to interviews with Base personnel, polychlorinated biphenyl (PCB)-containing transformer fluids may have been disposed in the ditch in the northern portion of this site. The site is currently unpaved and covered with bare ground.

**Initial Response Actions:** During the OU-1 RI, geophysical and soil gas surveys were conducted to define the landfill boundaries and select locations for test pits. Investigative activities included excavating four test pits and sampling ten soil borings. Two additional soil borings were advanced in August 1996 to collect additional VOC and SVOC data for risk assessment purposes.

Relatively high PCB concentrations (2,300 mg/kg) were detected at the site; however, this concentration was detected at 18 to 20 feet bgs and exposure is unlikely. Based on the results of the Basewide risk assessment, contaminants identified at LF-14 were not present at areas of potential exposure at concentrations high enough to cause adverse health effects under current land use scenarios. However, the concentrations of PCBs and chromium present in soils 0 to 16 feet

bgs could theoretically cause adverse health effects in the unlikely event that LF-14 were developed for residential purposes; therefore, remedial alternatives were developed for the site. Table 6 summarizes the past activities and environmental investigations at LF-14.

<b>Table 6</b>	
<b>Chronology of Events at LF-14: Old Salvage Yard Burial Site</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
1940s to 1950s	Former landfill site was part of the main drainage canal in the 1940s. The canal was abandoned when the path of the drainage was altered in the 1950s. The canal in the northern portion of the site was reportedly used as a disposal ditch for spent transformer fluids containing PCBs.
1962	Abandoned canal completely filled and covered
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
1992/1994; August 1996	Multi-phase RI conducted throughout OU-1 ; defined boundaries of former drainage ditch and characterized contents of landfill
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
June 15, 2000	VEMUR filed with county recorder
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
October 5, 2005	Site inspection completed
June 2007	Second Five-Year Review completed
September 1, 2011	Site inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due

### 3.5 LF-25: Northwest Landfill

**History of Contamination:** LF-25 consists of an area formerly used for landfiling and is located along the southwest boundary of Luke AFB, between the west perimeter and the northwest runway (Figure 7). This narrow site occupies approximately 43 acres. Portions of LF-25 are located immediately downrange of the Base skeet shooting range. Small, localized sections of the site were used as a landfill for construction debris in the past for an undetermined length of time, but it has not been used since 1989.

**Initial Response Actions:** During the OU-1 RI, geophysical and soil gas surveys were conducted to define landfill boundaries and select locations for test pits and soil borings. Lead and antimony were detected in the surface soils adjacent to the skeet range at concentrations that could cause adverse health effects if prolonged exposure, such as excavation work or residential occupation, were to occur. TRPH and benzo(a)pyrene were also detected in subsurface soils. In December 1999, shot recovery activities were conducted to reduce the concentrations of antimony and lead below their clean-up goals of 31 mg/kg and 400 mg/kg, respectively. The lead and antimony were present in the form of metal shot that was fired from the adjacent Base Skeet Shooting Range. Remedial alternatives were developed for the site as a protective measure.

Metal shot, containing lead and antimony, still routinely falls on the site because the adjacent Base Skeet Shooting Range is still active. Treatability studies conducted as part of the OU-1 FS (Geraghty & Miller, 1998) showed that as long as the shot is physically removed from the soil, residual lead and antimony concentrations would not present health concerns. Per the Basewide risk assessment, migration of the metals, TRPH, and benzo(a)pyrene is limited. Table 7 summarizes the past activities and environmental investigations at LF-25.

<b>Table 7</b>	
<b>Chronology of Events at LF-25: Northwest Landfill</b>	
<b>Date</b>	<b>Past Activities/investigations</b>
Pre-1989	Site was used as landfill; small portions of the site were used for the disposal of construction debris, and portions of the site are immediately downrange of the Base skeet shooting range.
July 14, 1989	Basewide NPL proposal
January 1990	Geophysical and organic vapor survey conducted in the southern portion of the site. 80 objects were identified and catalogued; one-third of the site was determined to be clear of metallic objects.
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
1992/1994; August 1996	Multi-phase RI conducted throughout OU-1
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
December 16-19, 1999	2,800 pounds of lead shot was removed from excavated surficial soil. Confirmation sampling indicated lead and antimony levels were below the SRLs.
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
June 15, 2000	VEMUR filed with county recorder
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
October 5, 2005	Site inspection completed

Table 7 (cont.) Chronology of Events at LF-25: Northwest Landfill	
Date	Past Activities/investigations
On-Going Activities	
June 2007	Second Five-Year Review completed
September 1, 2011	Site inspection completed
2012	Third Five-Year Review Report due

### 3.6 RW-02: Wastewater Treatment Annex Landfill

**History of Contamination:** RW-02 is a former 28-acre landfill at the Luke AFB wastewater treatment plant (WWTP) annex, located north of Glendale Avenue and approximately two miles east of the Base (Figure 8). The former landfill is located in the northwestern portion of the WWTP annex, adjacent to the western bank of the Agua Fria River. RW-02 served as the primary Base landfill for the disposal of refuse from 1953 until 1970. In 1990, the river bank bordering the landfill was stabilized by the U.S. Army Corps of Engineers to prevent erosion.

In 1956, a small quantity of low-level radioactive electron tubes and dials were buried at the landfill. The radioactive material was reportedly encased in concrete and buried in a 12-foot deep pit, first covered with 4 feet of concrete and then 6 feet of earth. The burial site is located within the boundaries of the former Defense Reutilization Marketing Office (DRMO) storage yard. This area is surrounded by a fence placarded as a radioactive waste burial site, and the burial site is designated with a permanent concrete marker.

**Initial Response Actions:** During the OU-1 RI, geophysical and soil gas surveys were performed to define the landfill. Ten test pits and 16 soil borings were advanced as part of the OU-1 investigation. Two soil borings were advanced to assess the integrity of the radiological waste containment structure. Investigations at RW-02 indicated that the contaminant concentrations were not high enough to cause adverse health effects under current land use scenarios and that soil near the alleged buried radioactive waste had not been impacted. However, the presence of the low-level radiological waste containment structure limits the potential future land use. On-going annual gamma radiation monitoring of dry wells around the radioactive waste burial site is performed as part of the LTM program. Table 8 summarizes the past activities and environmental investigations at RW-02.

<b>Table 8</b> <b>Chronology of Events at RW-02: Wastewater Treatment Annex Landfill</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
1953 to 1970	Site was used as primary Base landfill, accepting general refuse
1956	Small quantity of low-level radioactive tubes and dials was buried at the landfill. The waste was reportedly encased in concrete, buried in a 12-foot pit, covered with 4 feet of concrete and 6 feet of soil. The area is surrounded by a fence with a radioactive waste burial site placard.
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
1991	Two soil borings were advanced near the radiological waste structure. Soil samples were analyzed for radionuclides.
1992	Background soil boring installed and sampled during RI. Soil samples were analyzed for alpha and beta radiation; alpha and beta radiation was not significantly different from background location. The borehole for nearby MW-115 was logged for gamma radiation and was found to be within the range of naturally-occurring levels.
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
December 1999	Radiological monitoring points (dry wells) installed at 20 feet bgs. Four monitoring points near the source; one is background location.
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
June 15, 2000	VEMUR filed with county recorder
January 2000	Long-Term Radiological Monitoring Plan completed
April 26, 2001	USEPA concurrence with Final Close-Out Report
August 8, 2002	Radiological monitoring event conducted
January 2002	First Five-Year Review completed. Based on ADEQ recommendation, MW-124 will be sampled at every 5-year review cycle. Site was added to Luke AFB LTM program.
April 22, 2002	Luke AFB delisted from NPL
August 26, 2003	Radiological monitoring event conducted
July 12, 2004	Radiological monitoring event conducted
July 21, 2005	Radiological monitoring event conducted
August 21, 2006	Radiological monitoring event conducted. MW-124 was collapsed, so groundwater samples were not collected.
August 21, 2006	Site inspection completed
June 2007	Second Five-Year Review completed
February 2008	Two new wells (MW-124-S and MW-124-D) installed and sampled
April 2008	MW-124 abandoned
July 2, 2008	Radiological monitoring event conducted
May 21, 2009	Radiological monitoring event conducted
May 12, 2010	Radiological monitoring event conducted

Table 8 (cont.) Chronology of Events at RW-02: Wastewater Treatment Annex Landfill	
Date	Past Activities/Investigations
May 9, 2011	Radiological monitoring event conducted; site inspection completed
May 11, 2011	Groundwater sample collected from MW-124-S
On-Going Activities	
2012	Third Five-Year Review Report due
May 2012	Next round of radiological monitoring scheduled

### 3.7 SD-38: Oil/Water Separator at Auto Body Shop

**History of Contamination:** SD-38 is located near the middle of the Base at the northwest corner of "D" Street and 3rd Street (Figure 9). The site consists of the former oil/water separator serving Building 248, the old Base Auto Hobby Shop. In March 1991, the SD-38 oil/water separator was inspected as part of the Resource Conservation and Recovery Act (RCRA) facilities assessment. It was discovered that this oil/water separator did not have a concrete bottom. This separator has since been removed. The Base submitted samples of the sludge from the bottom of the oil/water separator for laboratory analysis. Other than the sludge sampling, no previous investigations or environmental sampling was performed at this site prior to the OU-1 RI.

**Initial Response Actions:** SD-38 was originally assigned to the OU-2 investigation. Because three soil borings conducted as part of the OU-2 investigation indicated a deep soil impact and a potential threat to groundwater, the site was reclassified as an OU-1 PSC.

In May 1992, during the OU-1 investigation, three soil borings were advanced and sampled to further evaluate the nature and extent of the impact at the site. A groundwater monitoring well (MW-117) was also installed and sampled at this time to evaluate groundwater quality at SD-38. In August 1996, one additional boring was advanced and sampled to collect supplemental VOC and SVOC data for use in the risk assessment.

Soil samples collected directly beneath the former oil/water separator at a depth of 8 feet bgs contained TRPH at a concentration of 58,000 mg/kg. Based on the results of the Basewide risk assessment, prolonged exposure to this concentration of TRPH could potentially cause adverse health effects, although direct exposure is not likely under current land use scenarios because the soils containing elevated concentrations of TRPH are located at depth. However, prolonged exposure to the TRPH in the subsurface soils could result if the site were developed for residential purposes; therefore, remedial alternatives were developed for SD-38. Table 9 summarizes the past activities and environmental investigations at SD-38.

<b>Table 9</b> <b>Chronology of Events at SD-38: Oil/Water Separator at Auto Body Shop</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
March 1991	Site consists of former oil/water separator serving Building 248, the old Auto Hobby Shop. Site inspected as part of RCRA facilities assessment. It was found that the oil/water separator did not have a concrete bottom, so sludge samples were collected; no analytical results are available.
May 1992	Site reclassified as an OU-1 PSC. Site was originally classified as an OU-2 PSC, but soil borings indicated a potential threat to groundwater.
1992/1994	Multi-phase RI conducted throughout OU-1. Soil samples indicated the highest total recoverable petroleum hydrocarbons contamination was located directly below the former separator, which was removed. VOCs were detected up to 200 feet bgs and SVOCs were detected up to 100 feet bgs, although the data did not meet QC requirements and were not used.
August 1996	Additional soil sampling was conducted to verify the presence of organic compounds; no VOCs or SVOCs were reported.
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
June 15, 2000	VEMUR filed with county recorder
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
August 2005	Site inspection completed
June 2007	Second Five-Year Review completed
September 1, 2011	Site inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due

### 3.8 SS-42: Bulk Fuels Storage Area

**History of Contamination:** SS-42 consists of a former leaking underground storage tank (UST) site located within the eastern portion of the bulk fuels storage area of the Base (Figure 10). The leaking UST was part of an oil/water separator system that received condensate from the two large aboveground fuel tanks.

In March 1993, unusually heavy rains caused the soil around the UST to settle. The settling apparently caused the fill line to dislodge from the tank and result in a release. The oil/water separator and UST were removed from service and excavated. In September 1993, a new oil/water separator with an aboveground storage tank was installed approximately 150 feet to the southwest of the original oil/water separator system location.

**Initial Response Actions:** In March 1993, investigations were completed in response to the release from the oil/water separator UST. Seven soil borings were advanced adjacent to the oil/water separator and leaking UST. Several of the borings, advanced to define the horizontal and vertical extent of the impact, contained detections of BTEX and TRPH. Samples collected from as deep as 160 feet bgs reported detections. Because of these unexpected detections, the horizontal extent of the impact could not be defined.

During the OU-1 RI, TPH and BTEX concentrations were detected in samples collected at depths ranging from 10 to 160 feet bgs. The highest detected concentration of TPH was 33,900 mg/kg at a depth of 70 feet bgs. BTEX compounds also were detected at their highest concentrations at 70 feet bgs. Based on the results of the Basewide risk assessment, contaminants identified at the site were not present at areas of potential exposure at concentrations high enough to cause adverse health effects under the current land use scenario. However, results of the vadose zone transport modeling indicated that petroleum related contaminants (TPH and BTEX) detected in the soil could migrate to the underlying groundwater resources; therefore, remedial alternatives were developed for the site.

Luke AFB completed a bioventing treatment study in 1995 and installed an SVE system in 1996. The system was operational from August 1996 through November 1998. Confirmation soil borings were emplaced to determine the effectiveness of the SVE system in mitigating the soil source. Based on analytical results, the SVE system removed nearly 400,000 pounds of volatile hydrocarbons from the soil. Although TPH and BTEX were detected in at-depth soil samples, levels were substantially reduced. Modeling results indicated that residual TPH and BTEX would not impact groundwater at concentrations above Arizona Water Quality Standards (AWQSS). The remedial alternative selected for SS-42 consisted of long-term groundwater monitoring. Table 10 summarizes the past activities and environmental investigations at SS-42.

<b>Table 10</b> <b>Chronology of Events at SS-42: Bulk Fuels Storage Area</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
March 1993	Settlement of UST caused the fill line to dislodge from the tank and a leak occurred. The UST was part of an oil/water separator system.



<b>Table 10 (cont.)</b> <b>Chronology of Events at SS-42: Bulk Fuels Storage Area</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
March through July 1993	Investigation conducted to delineate the contamination. Seven soil borings were advanced from 70 to 160 feet bgs, and BTEX was detected at 160 feet bgs; the horizontal impact was not defined. The site was added to the FFA as a PSC.
August 1993	PSC SS-42 assigned to OU-1.
1992/1994	Multi-phase RI conducted throughout OU-1. TPH and BTEX were reported in soil samples collected from as deep as 160 feet bgs; the highest TPH contamination was reported at 70 feet bgs. Although the Basewide risk assessment determined the contaminants were below allowable levels, remedial alternatives were developed for the site due to the depth of the soil contamination.
May 1995	Luke AFB initiated source removal by implementing a bioventing treatability study
August 6, 1996	SVE system operational
June 1997	Soil boring advanced to monitor the effectiveness of the SVE
August 1997	Final inspection of OU-1 PSCs
November 2, 1998	SVE system shutdown
January 7, 1999	Soil boring advanced to determine the effectiveness of SVE. Nearly 400,000 pounds of VOCs were removed from the soil. TPH and BTEX were detected in soil samples, but modeling results indicated the levels would not impact groundwater at concentrations above AWQs.
September 7, 1999	OU-1 ROD signed
December 1999	LTM Plan for PSC SS-42 completed
April 2000	Final site inspection by USEPA and ADEQ conducted
May 12, 2000	Groundwater LTM Plan for site submitted
May 16, 2000	Annual LTM groundwater sampling completed
May 22, 2000	SVE and confirmation sampling summary report submitted
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
August 2003	Annual groundwater sampling completed
June 2004	Annual groundwater sampling completed
April 2005	Annual groundwater sampling completed
August 2006	Annual groundwater sampling completed
August 23, 2006	Site inspection completed
June 2007	Second Five-Year Review completed
March/July 2008	Two new wells (MW-121-S and MW-125R-S) installed and sampled during annual groundwater sampling
May 2009	Annual groundwater sampling completed

Table 10 (cont.) Chronology of Events at SS-42: Bulk Fuels Storage Area	
Date	Past Activities/Investigations
May 2010	Annual groundwater sampling completed
May 2011	Annual groundwater sampling completed
September 1, 2011	Site inspection completed
On-Going Activities	
2012	Third Five-Year Review Report due
May 2012	Next round of groundwater monitoring scheduled

### 3.9 SD-20: Oil/Water Separator Canal and Earth Fissures

**History of Contamination:** SD-20 consists of a drainage canal located on the southern side of Luke AFB. This unlined canal originates at oil/water separator 912, approximately 100 feet north of Super Sabre Street, and extends southward into the Bullard Wash (Figure 11). The oil/water separator 912 system serves two stormwater drainage systems: a 30-inch diameter system for the areas to the northwest and a 43-inch diameter system for an area to the northeast. During past storm events, stagnant, oily water in the 30-inch diameter system occasionally overflowed into the oil/water separator canal. Upgrades to the Base's sewer system have greatly reduced the potential for additional industrial-waste discharges to the canal. Two earth fissures, apparently resulting from differential land subsidence, are known to exist approximately one-half mile downstream and off-base, along the drainage canal.

**Initial Response Actions:** During the OU-1 RI, soil borings were advanced and soil, sediment, and groundwater samples were collected. Studies also investigated the earth fissures and the effect of the nearby Luke Salt Body on contaminant migration and transport. The soils at SD-20 were found to contain total recoverable petroleum hydrocarbons (TRPHs), benzo(a)pyrene, arsenic, and beryllium at low concentrations. Based on the results of the RI, soil and groundwater contamination was not present at high enough levels to present an unacceptable risk to human health or the environment. Based on this conclusion, remedial alternatives were not developed for SD-20. However, after the First Five-Year Review, ADEQ requested that monitoring wells MW-112S, MW-112D, and MW-113 be sampled at every 5-year review cycle. The site was subsequently added to the Luke AFB LTM program. Table 11 summarizes the past activities and environmental investigations at SD-20.

<b>Table 11</b> <b>Chronology of Events at SD-20: Oil/Water Separator Canal and Earth Fissure</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
1988	Site investigated during Phase II IRP investigation; site consists of drainage canal that originates at oil/water separator #912 and extends southward.
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
1995	Investigation of hydrogeology, land subsidence, and earth fissures performed and reported by USGS
1992/1994; August 1996	Multi-phase RI conducted throughout OU-1
August 1997	Final inspection of OU-1 PSCs
September 7, 1999	OU-1 ROD signed
April 2000	Final site inspection by USEPA and ADEQ conducted
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed. Based on ADEQ recommendation, MW-112S, MW-112D, and MW-113 added to the LTM program and will be sampled at every 5-year review cycle.
April 22, 2002	Luke AFB delisted from NPL
August 2006	Groundwater samples collected from wells MW-112S, MW-112D, and MW-113 under LTM program
October 5, 2005	Site inspection completed
June 2007	Second Five-Year Review completed
February/March 2008	Two new wells (MW-122S-S and MW-113-S) installed and sampled
November 2008	Earth fissure map prepared by Arizona Geological Survey
May 2011	Groundwater samples collected from wells MW-112S-S, MW-112D, and MW-113-S under LTM program
September 1 and 8, 2011	Site inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due

### 3.10 ST-18: Former Liquid Waste Storage Facility

**History of Contamination:** ST-18 consists of a former liquid waste storage facility located in the southern part of Luke AFB (Figure 12). Facility 993 originally consisted of a single 5,000-gallon refueling tank truck that was coated and buried in 1968. The buried tank truck was used for the temporary storage of all liquid POL waste, and solvent wastes generated at the Base. Before 1972, liquid wastes stored at this facility were disposed by spraying them on the road during road oiling and dust suppression activities, pouring the waste into narrow trenches, and using the waste as an incendiary during fire training activities. In 1972, two 10,000-gallon USTs were installed at the facility, and the area around all three USTs, approximately 0.2 acres, was enclosed with a fence. At this time, the Base began selling the liquid wastes to private contractors for off-base recycling. This facility was classified as an interim status treatment, storage, and disposal facility under RCRA in 1979. Part A of a Hazardous Waste Permit application was submitted in 1980. However, closure of this facility began in 1982 to facilitate the construction of a new USAF Reserve aircraft maintenance building.

**Initial Response Actions:** The three USTs were removed on October 19, 1983. The soil samples collected from directly beneath the 5,000-gallon buried tanker truck and one of the 10,000-gallon USTs showed signs of impact from past waste releases. The tank pit was excavated to a depth of 16 feet bgs in an attempt to assess the extent of contamination. Based on field observations, highly impacted soils were manifested to a hazardous waste landfill. The moderately contaminated soils were aired for several weeks and replaced in the pit, and the minimally contaminated soils were placed directly back into the pit.

Because this site was an active facility in 1981, it was not identified during the Installation Restoration Program (IRP) Phase I investigation, which focused on historic waste disposal activities. However, the Base decided to include this site in the IRP Phase II investigation because of the sampling results from the UST closure activities. Between November 4, 1985 and February 6, 1986, five soil borings were advanced in and around Facility 993. The depths of the soil borings ranged from 100 to 145 feet bgs. In addition, five groundwater monitoring wells were installed in late 1986. The results indicated that the soil beneath the former USTs had been impacted by fuel and organic solvents, and that the impacted soil extended to 56.5 feet bgs.

The site was capped with concrete in 1987 as part of the RCRA post-closure requirements for the site. In a letter dated May 13, 1988, ADEQ stated it had inspected the concrete cap covering the facility and it was satisfactory. Currently, the Base continues to inspect and maintain the cap to ensure the integrity of the concrete and sealed joints. Groundwater at ST-18 is monitored in accordance with the Long-Term Monitoring Plan (Geraghty & Miller, 1997). Table 12 summarizes the past activities and environmental investigations at ST-18.

<b>Table 12</b> <b>Chronology of Events at ST-18: Former Liquid Waste Storage Facility (Facility 993)</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
1979	Site classified as RCRA interim status treatment, storage, and disposal facility
1980	RCRA Part A Hazardous Waste permit submitted
1982	RCRA closure activities began
July/August 1983	No contamination reported in soil samples collected at 50 feet bgs. A partial closure plan was submitted to ADHS.
October 4, 1983	ADHS approves partial closure plan
October 19, 1983	The three USTs at Facility 993 are excavated. Visual evidence of contamination is observed.
November 1985 to February 1986	Site characterization activities were conducted under IRP Phase I. Five soil borings were advanced over 100 to 145 feet bgs and monitoring wells were installed through the borings. The deepest contamination occurred at 56.5 feet bgs.
May 1987	Site is capped with concrete taxiway
May 13, 1988	Letter prepared by ADEQ stated the cap was inspected and it is adequate
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
December 1991 to June 1992	Multi-phase RI/FS conducted throughout OU-2. Soil samples contained TRPH, VOCs, and SVOCs; groundwater samples showed no contamination.
May 12, 1993	Proposed Plan presented to the public and accepted
January 28, 1994	OU-2 ROD signed
August 1996	Additional sampling conducted. The highest concentration of TPH was reported at 18,000 mg/kg at 18 to 20 feet bgs. The risk assessment was recalculated and the selected remedial alternative identified in the ROD was determined to be adequate and protective.
August 1997	Final site inspection conducted
1999	Repairs made to concrete cap
January 5, 2000	Base General Plan revised to reflect land use restrictions at the site
April 2000	Final site inspection by USEPA and ADEQ conducted
May 12, 2000	Groundwater LTM Plan submitted
April 26, 2001	USEPA concurrence with Final Close-Out Report
August 2001	Repairs made to concrete cap
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
2003	Repairs made to concrete cap
August 2003	Annual groundwater sampling and cap inspection completed
June 2004	Annual groundwater sampling and cap inspection completed
April 2005	Annual groundwater sampling and cap inspection completed
August 2006	Annual groundwater sampling and cap inspection completed

<b>Table 12 (cont.) Chronology of Events at ST-18: Former Liquid Waste Storage Facility (Facility 993)</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
August 22, 2006	Site inspection completed
December 2006	Cap inspection completed
June 2007	Second Five-Year Review completed
March / July 2008	Two new wells installed (MW-114-S and MW-122-S) and sampled during annual groundwater monitoring
January 2009	Repairs made to concrete cap
May 2009	Annual groundwater sampling and cap inspection completed
May 2010	Annual groundwater sampling and cap inspection completed
December 2010	Repairs made to concrete cap
May 2011	Annual groundwater sampling and cap inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due
May 2012	Next round of annual groundwater monitoring and cap inspection scheduled

### 3.11 DP-23: Old Surface Impoundment West of Facility 993

**History of Contamination:** DP-23 consists of the old surface impoundment and associated drainage swale located west of Building 999 and adjacent to the former south fire training area (Figure 13). The northern portion of the old surface impoundment is a rectangular-shaped area that occupies approximately 3.3 acres. Eighty percent of this area is either paved with asphalt, under tarmac, or under concrete, which includes the canal liner and the Above Ground Equipment (AGE) equipment yard. In the late 1940s, an impoundment dam was constructed along an old natural drainage system which flowed south off of the Base. This area may have been used as a disposal site for POL waste until construction covered the site in 1969. The dam used to create the surface impoundment was buried, but not removed. The swale portion of the site is located to the south of the impoundment area and occupies approximately 19.4 acres. The swale flows south to an area of earth fissures off Base.

**Initial Response Actions:** In February 1992, two 150-foot soil borings and four 40-foot soil borings were drilled and sampled during the OU-2 investigation. Sediment samples were collected from ten locations in December 1991 and February 1992. A total of 26 soil samples and 21 sediment samples were collected and submitted for laboratory analysis.

The highest detected concentration of TRPH was 2,000 mg/kg in the 2 to 4 foot bgs sample collected from one of the soil borings. The only detected VOC compounds (trace concentrations of toluene and ethylbenzene) were also detected in this sample. TRPH was generally confined to shallow soils. The deepest sample with detectable TRPH concentrations was collected from 8 to 10 feet bgs.

Six soil and five sediment samples collected during the OU-2 investigation contained detectable concentrations of SVOC compounds. Four samples contained concentrations of benzo(a)pyrene in excess of its stated Preliminary Remediation Goal (PRG) of 0.78 mg/kg. These four samples included the two surface samples, a two-to-four-foot bgs sample, and a duplicate sample. None of the other samples contained SVOC compounds at concentrations in excess of their respective PRGs. Table 13 summarizes the past activities and environmental investigations at DP-23.

In July 1995, the Base constructed an on-site treatment cell in which to compost polycyclic aromatic hydrocarbons (PAHs) contaminated soils by emplacing berms and lining the bermed area with 40-milliliter high density polyethylene (HDPE) liner, topped with 6 inches of native fill. In all, 625 cubic yards of soil contaminated with benzo(a)pyrene at levels above the PRG were excavated and placed in the treatment cell for composting. Baseline samples were collected for later comparison to post-treatment samples. Soils were tilled and watered daily and monitored for temperature, oxygen, and moisture levels. After 120 days, interim samples were collected at baseline locations to determine the effectiveness of the composting: 25 percent remained above the PRG for benzo(a)pyrene. An optimized soil amendment mix was added to the compost and soil composting continued for an additional 60 days. Final sampling was conducted and all samples were stated to be below the PRG for benzo(a)pyrene. The treated soils were used as fill to restore the site to its original grade and the site was hydro-seeded. The HDPE liner was disposed at a local landfill. A site closure report was prepared and approved in 1997.

<b>Table 13</b> <b>Chronology of Events at DP-23: Old Surface Impoundment West of Facility 993</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
July 14, 1989	Basewide NPL proposal
August 30, 1990	Basewide NPL listing
September 27, 1990	FFA signed, transferring jurisdiction to CERCLA
December 1991 to June 1992	Multi-phase RI/FS conducted throughout OU-2. Characterized soil contamination at the site.
May 12, 1993	Proposed Plan presented to the public and accepted
January 28, 1994	OU-2 ROD signed
May 1994	Remedial design report was prepared and approved for composting operation to be conducted in on-site treatment cell
April 11, 1995	Preliminary soil sampling conducted to further characterize soil contamination at the site. Four PAH constituents were present in excess of PRGs; the site was recommended for more extensive investigation.
July 1995	On-site treatment cell was constructed; 625 cubic yards of soil contaminated with benzo(a)pyrene at levels exceeding the PRG were excavated and placed in the composting treatment cell.
October 1995	Interim samples were collected to determine the effectiveness of the composting; 25% of the soil remained above the PRG for benzo(a)pyrene

<b>Table 13 (cont.)</b> <b>Chronology of Events at DP-23: Old Surface Impoundment West of Facility 993</b>	
<b>Date</b>	<b>Past Activities/Investigations</b>
April 3, 1997	An optimized soil amendment mix was added to the compost
June to August 1997	Final sampling conducted. All samples were below the PRG for benzo(a)pyrene.
August 1997	Final site inspection conducted; site restoration included regarding and hydroseeding
August 27, 1997	Final closure report submitted
April 2000	Final site inspection by USEPA and ADEQ conducted
April 26, 2001	USEPA concurrence with Final Close-Out Report
January 2002	First Five-Year Review completed
April 22, 2002	Luke AFB delisted from NPL
August 22, 2006	Site inspection completed
June 2007	Second Five-Year Review completed
September 1, 2011	Site inspection completed
<b>On-Going Activities</b>	
2012	Third Five-Year Review Report due



## 4.0 BASIS FOR TAKING ACTION

Remedial actions taken were focused on eliminating exposures to soil associated with significant human health risks, which are defined as those sites that exceeded USEPA and/or ADEQ risk management criteria as described in the Basewide risk assessment.

Soil concentrations were compared to PRGs and Soil Remediation Levels (SRLs). Groundwater concentrations were compared to USEPA Maximum Contaminant Level (MCLs), PRGs, and ADEQ's AWQSs, whichever is the most conservative, in order to evaluate the protectiveness of the remedies. Tables 14 and 15 summarize analytes with concentrations that exceeded the applicable screening levels for each of the PSCs.

<b>Table 14</b> <b>Groundwater Detections Exceeding Screening Levels</b>				
PSC	Parameter	Screening Level (mg/L)	Max Conc (mg/L)	Action
FT-07E	Lead	0.004 <sup>a</sup>	0.008	Site part of LTM, sampled every 5 years
RW-02	Arsenic	0.000045 <sup>a</sup>	0.017	Site part of LTM, sampled every 5 years
	Lead	0.004 <sup>a</sup>	0.018	
SS-42	Arsenic	0.000045 <sup>a</sup>	0.007	Site part of LTM, sampled annually
	Chromium	0.1 <sup>b</sup>	3.84	
SD-20	Arsenic	0.000045 <sup>a</sup>	0.026	Site part of LTM, sampled every 5 years
	Lead	0.004 <sup>a</sup>	0.048	
ST-18	Arsenic	0.000045 <sup>a</sup>	0.019	Site part of LTM, sampled annually
	Lead	0.004 <sup>a</sup>	0.026	

Notes: Source of maximum concentrations = OU-1 and OU-2 RIs; mg/L = milligrams per liter; screening level = the most conservative value of AWQS, MCL, or Region IX tap water PRG at time of RODs; LTM = long-term monitoring; <sup>a</sup> = Based on 1996 USEPA preliminary remediation goal (PRG); <sup>b</sup> = Based on Arizona aquifer water quality standard (AWQS)

<b>Table 15</b> <b>Soil Detections Exceeding Screening Levels</b>				
PSC	Parameter	Screening Level (mg/kg)	Max Conc. (mg/kg)	Action
DP-13	Benzo(a)anthracene	0.61 <sup>a</sup>	0.64	Detections at depth (>5 ft bgs); direct exposure under current land use minimal; VEMUR in place to restrict future land use
	Benzo(a)pyrene	0.061 <sup>a</sup>	0.56	
	Benzo(b)fluoranthene	0.61 <sup>a</sup>	0.63	
	Dibenz(a,h)anthracene	0.061 <sup>a</sup>	0.11	
	TRPH	4,110 <sup>b</sup>	12,000	
	Arsenic	0.38 <sup>a</sup>	19	
	Beryllium	0.14 <sup>a</sup>	0.8	
	Chromium	210 <sup>a</sup>	15,900	
	Copper	2,800 <sup>a</sup>	3,900	
	Lead	400 <sup>a, b</sup>	36,000	

**Table 15 (cont.)**  
**Soil Detections Exceeding Screening Levels**

PSC	Parameter	Screening Level (mg/kg)	Max Conc. (mg/kg)	Action
FT-07E	TRPH	4,110 <sup>b</sup>	27,000	Detections at depth (>8 ft bgs); direct exposure under current land use minimal; VEMUR in place to restrict future land use
	Arsenic	0.38 <sup>a</sup>	9.0	
LF-03	Arsenic	0.38 <sup>a</sup>	15.9	Detections at depth (>2 ft bgs for beryllium and >4 ft bgs for others); direct exposure under current land use minimal; VEMUR in place to restrict future land use
	Beryllium	0.14 <sup>a</sup>	0.7	
	Chromium	210 <sup>a</sup>	386	
	Copper	2,800 <sup>a</sup>	4,700	
	Lead	400 <sup>a, b</sup>	796	
LF-14	Benzo(a) pyrene	0.061 <sup>a</sup>	0.3	Direct exposure under current land use minimal; VEMUR in place to restrict future land use
	PCBs	0.066 <sup>a</sup>	37	
	TRPH	4,110 <sup>b</sup>	2,400	
	Arsenic	0.38 <sup>a</sup>	14	
	Beryllium	0.14 <sup>a</sup>	1.5	
	Chromium	210 <sup>a</sup>	376	
LF-25	Benzo(a) pyrene	0.061 <sup>a</sup>	0.1	Direct exposure under current land use minimal; VEMUR in place to restrict future land use
	TRPH	4,110 <sup>b</sup>	290	
	Antimony	31 <sup>a</sup>	368	
	Arsenic	0.38 <sup>a</sup>	16	
	Beryllium	0.14 <sup>a</sup>	7.6	
	Lead	400 <sup>a, b</sup>	10,100	
RW-02	Benzo(a) pyrene	0.061 <sup>a</sup>	0.1	Annual gamma radiation monitoring is part of LTM; VEMUR in place to restrict future land use
	TRPH	4,110 <sup>b</sup>	4100	
	Arsenic	0.38 <sup>a</sup>	19	
	Beryllium	0.14 <sup>a</sup>	0.7	
	Cadmium	38 <sup>a, b</sup>	58	
	Copper	2,800 <sup>a, b</sup>	4,840	
	Lead	400 <sup>a, b</sup>	680	
	Radium-226	0.61 pCi/g	0.752 pCi/g	
	Radium-228	0.6025 pCi/g	0.739 pCi/g	
SD-38	TRPH	4,110 <sup>b</sup>	58,000	TRPH detections at depth (>6 ft bgs); direct exposure under current land use minimal; VEMUR in place to restrict future land use
	Arsenic	0.38 <sup>a</sup>	14	
	Beryllium	0.14 <sup>a</sup>	1.0	
	Lead	400 <sup>a, b</sup>	470	
SS-42	TPH	4,110 <sup>b</sup>	33,900	SVE system operated from 1996 – 1998; internal land use restriction documented in ICP
	Benzo(b) fluoranthene	0.61 <sup>a</sup>	1.43	

Table 15 (cont.) Soil Detections Exceeding Screening Levels				
PSC	Parameter	Screening Level (mg/kg)	Max Conc. (mg/kg)	Action
SD-20	Benzo(a)pyrene	0.061 <sup>a</sup>	0.3	Site continued to be monitored as part of LTM
	TRPH	4,110 <sup>b</sup>	3,700	
	Arsenic	0.38 <sup>a</sup>	26	
	Beryllium	0.14 <sup>a</sup>	0.9	
ST-18	Benzene	1.2 <sup>a</sup>	6.4	Detections at depth (>12 ft bgs); direct exposure under current land use minimal; internal land use restriction documented in ICP
	1,1-Dichloroethene	0.054 <sup>c</sup>	1.0	
	1,1,2,2-Tetrachloroethane	0.38 <sup>c</sup>	3.0	
DP-23	Benzo(a)pyrene	0.061 <sup>a</sup>	3.3	Onsite treatment cell constructed in 1995; internal land use restriction documented in ICP
	TRPH	4,110 <sup>b</sup>	2,000	

Notes: Source of maximum concentrations = OU-1 and OU-2 RIs; mg/kg = milligrams per kilogram; screening level = the most conservative value of ADEQ Soil Remediation Level (SRL) or Region IX Preliminary Remediation Goal (PRG) at time of RODs; TRPH = Total recoverable petroleum hydrocarbon; ft bgs = feet below ground surface; LTM = long-term monitoring; ICP = institutional control plan; maximum concentrations listed for FT-07E are post-remediation; pCi/g = picocuries per gram; Radium-226 and Radium-228 do not have Region IX PRGs, so the average value of background samples was used; <sup>a</sup> = Based on 1996 USEPA residential preliminary remediation goal (PRG); <sup>b</sup> = Based on 1997 Arizona residential soil remediation level (SRL); <sup>c</sup> = Based on 2000 USEPA residential PRG

## 5.0 REMEDIAL ACTIONS

This Third Five-Year Review covers remedial actions at both OU-1 and OU-2 sites. Remedial alternatives were developed for sites not deemed suitable for unrestricted land use, based on the results of the RI. Remedial alternatives also were developed for sites that could potentially impact the underlying groundwater resources in the future.

### 5.1 Remedy Selection

As part of the OU-1 and OU-2 RI, a Basewide risk assessment was conducted to evaluate the potential risks to human health and the environment that could result from exposure to the air, soil, surface water, and groundwater at Luke AFB. The results of the RI and Basewide risk assessment indicated that the air, surface water, and groundwater resources at Luke AFB did not represent conditions that would pose an imminent and substantial endangerment to public health, welfare, or the environment. However, the soils at several PSCs were found to have conditions that could either cause unacceptable human health risks under certain types of land use scenarios, or could potentially impact the underlying groundwater. Remedial alternatives described in Table 16 were developed for the soils at those eleven sites.

<b>Table 16</b>	
<b>Summary of Remedial Alternatives for OU-1 and OU-2 PSCs</b>	
<b>PSC</b>	<b>Remedial Alternative</b>
<b>OU-1</b>	
DP-13	ICs including land use restriction through VEMUR
FT-07E	ICs including land use restriction through VEMUR; long-term groundwater monitoring added per ADEQ request after the First Five-Year Review Report
LF-03	ICs including land use restriction through VEMUR
LF-14	ICs including land use restriction through VEMUR
LF-25	Excavation of contaminated soil, ex situ mechanical treatment of contaminated soils, on-site disposal of treated soils, and institutional controls including land use restriction through VEMUR
RW-02	ICs to prevent exposure to low-level radioactive wastes buried at site and monitoring to assure integrity of concrete burial vault; also includes VEMUR
SD-20	No action based on RI; groundwater monitoring every five years added at ADEQ's request
SD-38	ICs including land use restriction through VEMUR
SS-42	Installation and operation of SVE system and annual long-term groundwater monitoring
<b>OU-2</b>	
DP-23	Southern portion = excavation, ex situ soil treatment via composting, on-site disposal of treated soils; Northern portion = ICs via internal land use restriction
ST-18	ICs including concrete cap, annual long-term groundwater monitoring and inspection of concrete cap, internal land use restriction

The selected remedy of ICs was chosen if wastes were buried and posed no exposure threat based on current land use scenarios. ICs were implemented by revising the Base General Plan (BGP) to reflect that land use restrictions had been placed on the site. The BGP serves as the primary mechanism that ensures the ICs and engineering controls are established and maintained. The BGP is reviewed and updated as needed.

The BGP's constraints against residential development and construction are enforced through procedures already in place at Luke AFB, specifically the use of AF Form 332, Civil Engineering Work Request, which is used to initiate and control all construction, maintenance, and development tasks on the Base. Forms 332 are reviewed, coordinated and approved by a weekly meeting of the multi-disciplinary Work Request Review Board (WRRB), which includes a representative from Community Planning. The Community Planner review the Form 332 against the location of restricted sites, and identifies potential conflicts that may require resolution before a task may proceed. The Community Planner consults with the Restoration Program Manager for more specific details and interpretation as required. The final approval of any building project resides with the Civil Engineering Chief of Operations, who signs all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form 332 that plans for the residential development of a residentially-restricted site, or disturbance of a site containing buried contaminants.

ICs also include the requirement of donning appropriate personal protective equipment (PPE) during excavation activities at use-restricted sites. All dig permits issued for a use-restricted site must include a provision detailing the use of PPE. The Restoration Program Manager is responsible to ensures that appropriate PPE is used during any future excavation work at these sites.

## **5.2 Remedy Implementation**

The following sections describe the selected remedies for each of the OU-1 and OU-2 sites under consideration in this Third Five-Year Review.

### **5.2.1 DP-13: Drainage Ditch Disposal Area**

The selected remedy for DP-13 was ICs, based on the determination made in the risk assessment that wastes were buried and posed no exposure threat based on the current land use scenarios. DP-13 was added to the Luke AFB ICP (Geraghty & Miller, 2000) to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB, coordinating with ADEQ, filed a VEMUR with the county recorder on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at five-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

### **5.2.2 FT-07E: Eastern Portion of North Fire Training Area**

The selected remedy for FT-07E was ICs, based on the determination made in the risk assessment that wastes were buried and posed no exposure threat based on the current land use scenarios. FT-07E was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with the county recorder on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at five-year intervals after signing of the ROD to determine the adequacy of ICs and current land use. Long-term groundwater monitoring results are summarized in Appendix D

### **5.2.3 LF-03: Outboard Runway Landfill**

The selected remedy for LF-03 was ICs, based on the determination made in the risk assessment that wastes were buried and posed no exposure threat based on the current land use scenarios. LF-03 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with the county recorder on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at five-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

### **5.2.4 LF-14: Old Salvage Yard Burial Site**

The selected remedy for LF-14 was ICs, based on the determination made in the risk assessment that impacted soils remain in place and pose no exposure threat based on current land use scenarios. LF-14 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with the county recorder on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at five-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

### **5.2.5 LF-25: Northwest Landfill**

The selected remedy for LF-25 was excavation of contaminated soils, ex situ mechanical treatment of contaminated soils, on-site disposal of treated soils, and ICs. Surface soils were removed from a 375-foot square area adjacent to the skeet range. Excavated soil was processed in a metals recovery unit, where approximately 2,800 pound of lead shot was removed. Confirmation sampling was conducted of remaining soil and lead and antimony levels were below the ADEQ's SRLs. Treated soils were returned to the excavated area, and the site was restored to grade.

ICs were established to restrict future development of the site. The ICs were implemented by revising the BGP in January 2000 to reflect that land use restrictions had been placed on the site. LF-25 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with the county recorder on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at five-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

#### **5.2.6 RW-02: Wastewater Treatment Annex Landfill**

The selected remedy for RW-02 was ICs to prevent exposure to low-level radioactive wastes buried at the site, and monitoring to assure that the integrity of the concrete burial vault has not been compromised and that groundwater has not been impacted.

ICs implemented at RW-02 include fencing around the radiological burial site with a placard that identifies it as a radiological waste site. The fencing and placard are inspected during the annual monitoring events. RW-02 was also added to the Luke AFB ICP to facilitate enforcement of land use restrictions as ICs and incorporated into BGP. Luke AFB filed a VEMUR with the county recorder on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

In November 2000, the Long-Term Radiological Monitoring Plan was developed, detailing the procedures and schedule for conducting down-hole radiological monitoring. The monitoring program consists of using portable field instrumentation to monitor gamma ray concentrations at four monitoring points and one background location that were installed at the site. The radiation action level was established at twice background.

Site inspections are required at five-year intervals after signing of the ROD to determine the adequacy of ICs and current land use. Annual radiation monitoring results are summarized in Appendix C and long-term groundwater monitoring results are summarized in Appendix D.

#### **5.2.7 SD-38: Oil/Water Separator at Auto Body Shop**

The selected remedy for SD-38 was ICs, based on the determination made in the risk assessment that impacted soils remain in place and pose no exposure threat based on current land use scenarios. SD-38 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with the county recorder on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at five-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

### **5.2.8 SS-42: Bulk Fuels Storage Area**

The selected remedy for SS-42 was the installation and operation of an SVE system to remediate the contaminated soil source and then groundwater monitoring to confirm the effectiveness of the SVE system. In May 1995, Luke AFB initiated an interim removal action to reduce the contaminant mass and concentrations in subsurface soils. A pilot-scale study was conducted to determine the effectiveness of SVE in remediating the contaminated soil source. Based on the results of the pilot study, operation of the full scale SVE system commenced in August of 1996. The extracted vapors were treated by using them to fuel a modified internal combustion engine that vented the wells. The SVE system operated until November 2, 1998, when it was shut down. Soil borings were advanced to determine the effectiveness of the SVE system in reducing the contaminant mass in subsurface soils. Based on analytical results, the SVE system removed approximately 400,000 pounds of volatile hydrocarbons from the soil. Though TPH and BTEX were still present in at-depth soil samples, levels were substantially reduced. Results of vadose zone modeling indicated that residual TPH and BTEX would not impact groundwater at concentrations above AWQSSs.

Internal land use restrictions, as documented in the BGP, are in place to prohibit residential development at SS-42. Groundwater samples are collected annually at SS-42 under the Luke AFB LTM program. Long-term groundwater monitoring results are summarized in Appendix D.

### **5.2.9 SD-20 Oil/Water Separator Canal and Earth Fissure**

Remedial alternatives were not developed for the SD-20 site because it was concluded from data collected during the RI that contaminants at SD-20 were not present at levels high enough to cause adverse health effects under current land use scenarios. The results of vadose zone transport modeling also indicated that any contaminants present in site soils would not migrate to underlying groundwater. However, after the First Five-Year Review was conducted, ADEQ requested that Luke AFB sample monitoring wells MW-112S, MW-112D, and MW-113 due to low level concentrations of trichloroethene (TCE), tetrachloroethene (PCE), and toluene reported during past sampling events. Based on ADEQ's request, Luke AFB samples these three SD-20 wells at every five-year review.

Internal land use restrictions, as documented in the BGP, are in place for the northern section of SD-20 that is located on Base property (Figure 11). Site inspections are required at five-year intervals and the long-term groundwater monitoring results are summarized in Appendix D.

### **5.2.10 ST-18: Former Liquid Waste Storage Facility**

The selected remedy for ST-18 in the OU-2 ROD was specified as ICs (capping and surface controls) and groundwater monitoring. The former USTs at ST-18 were removed in the early 1980s under RCRA closure activities conducted to allow construction of a new taxiway and USAF



reserve maintenance building. The site was capped with a concrete runway in 1987 to satisfy part of the RCRA post-closure requirements. Internal land use restrictions are in place to restrict future land use. Groundwater monitoring of on-site wells and inspection of the concrete cap is performed annually under the Luke AFB LTM program.

Internal land use restrictions, as documented in the BGP, are in place to prohibit residential development at ST-18. Groundwater monitoring and inspection of the concrete cap are performed annually at ST-18. Long-term groundwater monitoring results are summarized in Appendix D. The cap inspection results are summarized in Appendix E.

#### **5.2.11 DP-23: Old Surface Impoundment West of Facility 993**

DP-23 was divided into the southern portion and the northern portion. The remedy for the southern portion was excavation, ex situ soil treatment via composting, on-site disposal of treated soils, then subsequent monitoring. Based on the findings of the risk assessment, the remedy for the northern portion of DP-23 was ICs.

At the southern portion of DP-23, an on-site treatment cell was constructed by emplacing berms and lining the bermed area with 40-mL HDPE liner, topped with 6 inches of native fill. In all, 625 cubic yards of soil contaminated with benzo(a)pyrene at levels above the PRG were excavated and placed in the treatment cell for composting. Baseline samples were collected for later comparison to post-treatment samples. Soils were tilled and watered daily and monitored for temperature, oxygen, and moisture levels. After 120 days, interim samples were collected at baseline locations to determine the effectiveness of the composting. Twenty-five percent of the soils remained above the PRG for benzo(a)pyrene. An optimized soil amendment mix was added to the compost and soil composting continued for an additional 60 days. Final sampling was conducted, and all samples were reported to be below the PRG for benzo(a)pyrene. The treated soils were used as fill to restore the site to its original grade and the site was hydro-seeded. The HDPE liner was disposed at a local landfill.

Internal land use restrictions, as documented in the BGP, are in place to prohibit residential development at DP-23.

### **5.3 System Operation / Operation and Maintenance**

There are no active remedial systems in place at any of the PSCs. Therefore, there are no associated operating costs other than routine inspections. The frequency of inspections depends on the selected remedy for the site. Table 17 summarizes the schedule of required site inspections.

<b>Table 17</b> <b>Site Inspections Schedule</b>	
<b>PSC</b>	<b>Inspection Frequency</b>
<b>OU-1</b>	
DP-13	Every five years and as needed if construction/excavation occurs
FT-07E	Every five years and as needed if construction/excavation occurs
LF-03	Every five years and as needed if construction/excavation occurs
LF-14	Every five years and as needed if construction/excavation occurs
LF-25	Every five years and as needed if construction/excavation occurs
RW-02	Annual inspection of fencing around radiological waste burial site
SD-20	Every five years and as needed if construction/excavation occurs
SD-38	Every five years and as needed if construction/excavation occurs
SS-42	Annually in association with groundwater monitoring
<b>OU-2</b>	
DP-23	Every five years and as needed if construction/excavation occurs
ST-18	Annual inspection of concrete cap

## 6.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The selected remedies at OU-1 and OU-2 PSCs continue to protect human health and the environment. Long-term protectiveness of the removal and remedial actions will be verified by continuing to perform groundwater monitoring in order to evaluate the potential migration of contamination from the vadose zone to the groundwater. Ongoing sampling and analysis will be completed annually at SS-42 and ST-18 and every fifth year at FT-07E, RW-02, and SD-20.

Table 18 summarizes issues addressed from the Second Five-Year Review Report.

<b>Table 18</b>		
<b>Activities Since Second Five-Year Review Report</b>		
<b>PSC</b>	<b>Issue</b>	<b>Resolution</b>
<b>OU-1</b>		
FT-07E	Well MW-123 has collapsed	Three new wells (MW-118-S, MW-123S and MW-123-D) installed and MW-123 abandoned in April 2008
	Screen of well MW-118 is submerged; replace well with shallower screen interval	
	Continue groundwater monitoring at FT-07E	Groundwater monitoring was performed at MW-118-S and MW-123-S during May 2011
RW-02	Well MW-124 has collapsed and needs to be replaced	Two new wells (MW-124-S and MW-124-D) installed February 2008; MW-124 abandoned April 2008
	Continue gamma radiation and groundwater monitoring at RW-02	Gamma radiation monitoring performed July 2008, May 2009, May 2010 and May 2011; groundwater monitoring performed May 2011
SS-42	Screens of wells MW-121 and MW-125R are submerged; replace well with shallower screen interval	Two new wells (MW-121-S and MW-125R-S) installed March/April 2008
	The nickel result for MW-119 collected during 1994 was greater than AWQS	Long-term Monitoring Plan (ARCADIS, 1999) states that MW-119 cannot be sampled due to casing collapse. MW-122-S and MW-125R-S are monitored annually at SS-42 and nickel analysis will be added in the May 2012 monitoring event.
	ICP does not include SS-42; should be added in next revision	SS-42 is included in the ICP in Section 12 and Appendix G; ICs in place at SS-42 prohibit residential development
	Continue groundwater monitoring at SS-42	Groundwater monitoring performed July 2008, May 2009, May 2010 and May 2011
SD-20	Screen of well MW-113 is submerged; replace well with shallower screen interval	Two new wells (MW-112S-S and MW-113-S) installed February/March 2008;
	Continue groundwater monitoring at SD-20	Groundwater monitoring performed May 2011

<b>Table 18 (cont.)</b> <b>Activities Since Second Five-Year Review Report</b>		
<b>PSC</b>	<b>Issue</b>	<b>Resolution</b>
<b>OU-2</b>		
ST-18	Well MW-114 is blocked and screen is submerged; replace well with shallower screen interval	Two new wells (MW-1114-S and MW-122-S) installed February/March 2008;
	Base General Plan does not include ST-28; should be added in next revision	Base General Plan is currently being updated; however, ST-18 is currently included. ST-28 is not one of the PSC sites.
	Continue cap inspection and groundwater monitoring at ST-18	Groundwater monitoring and cap inspection performed July 2008, May 2009, May 2010 and May 2011
DP-23	ICP does not include DP-23; should be added in next revision	DP-23 will be included during next revision of the ICP; ICs in place at DP-23 prohibit residential development

## 7.0 FIVE-YEAR REVIEW PROCESS

This section discusses the administrative components of this Five-Year Review.

### 7.1 Administrative Components

This review was led by Mr. Alan Thomas, P.E. Mr. Thomas is the Restoration Program Manager at Luke AFB. Others that assisted with the review are:

- Xuan-Mai Tran, USEPA Region 9
- Travis Barnum, ADEQ
- Marla Miller, ARCADIS
- Gina Gerritzen, ARCADIS
- Tim Swavely, Stell Environmental Enterprises
- Cynthia Cash, Stell Environmental Enterprises

Table 19 summarizes the timeline of the five-year review process.

<b>Table 19</b>	
<b>Administrative Components</b>	
<b>Element</b>	<b>Date Range</b>
Community Involvement	December 2011
Document Review	June 2011 – December 2011
Site Inspection	September 2011
Interviews	September – December 2011
Report Development and Review	March 2011 – February 2012

#### 7.1.1 Community Involvement

The community advisory board (CAB) was disbanded in 1999. During the Second Five-Year Review Report, attempts were made to interview three former CAB members but only one individual (Joyce Clark) responded.

A public notice announcing the start of the five-year review process was published as a legal notification in three local newspapers on the dates listed below.

- *Arizona Republic* – 27 December 2011

- *Glendale Star* – week of 21 December 2011
- *Northwest Valley* – week of 21 December 2011

The public notice is provided below in italicized text. The affidavits for the notices are provided in Appendix F.

*Luke AFB was placed on the EPA's National Priorities List (NPL) in 1990 due to soil contamination resulting from past practices. After a joint effort with EPA and the Arizona Department of Environmental Quality (ADEQ) to perform investigation and cleanup, the base was removed from the NPL in 2002. Every five years a review is conducted to ensure the investigation and cleanup continue to be protective of human health and the environment. A Five-Year Review is currently in progress and is scheduled for completion in early 2012. Information about the site may be viewed at <http://cfpub.epa.gov/supercpad/cursites/csinfo.cfm?id=0900884>. The contaminants of concern for the base are volatile organic compounds, semivolatile organic compounds, and metals. Environmental issues at the Base are being or have been addressed by deed restrictions, plan modifications, soil capping, and various forms of contaminant removal. Interested parties may submit comments to Alan Thomas, Restoration Program Manager at 56 CES/CEAN; 13970 Gillespie Drive; Luke AFB, AZ 85309 or at [alan1.thomas@luke.af.mil](mailto:alan1.thomas@luke.af.mil).*

A second public notice will be placed in local newspapers after the Third Five-Year Review has been approved by regulatory authorities. The results of the review will be made available to the public at the Glendale Public Library, Peoria Public Library, and the USEPA Region 9 office.

### **7.1.2 Document Review**

The following regulatory guidance documents and publications were reviewed during preparation of this Third Five-Year Review:

- *Arizona Numeric Water Quality Criteria* (Arizona, 1996a)
- *Arizona Soil Remediation Levels* (Arizona, 1996b)
- *Comprehensive Five-Year Review Guidance* (USEPA, 2001)
- *Environmental Protection Agency Region 9 Preliminary Remediation Goals* (USEPA, 1996)

- *Environmental Protection Agency Region 9 Preliminary Remediation Goals* (USEPA, 2000)
- *Environmental Protection Agency Region 9 Preliminary Remediation Goals* (USEPA, 2004)
- *National Primary and Secondary Drinking Water Standards* (USEPA, 2003)
- *Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance* (USEPA, 2011)

The following historical site documents and reports were reviewed during preparation of this Third Five-Year Review. The documents were provided by Luke AFB:

- *Final Long-Term Monitoring Plan PSC SS-42 and ST-18* (ARCADIS, 2004)
- *Final Annual Groundwater Long-Term Monitoring Report* (Tierra Dynamic, 2009)
- *Groundwater Long-Term Monitoring Report August 2006 Sampling Event* (HGL, 2006)
- *Final First Five-Year Review* (ARCADIS, 2002a)
- *Final Second Five-Year Review* (HGL, 2007)
- *Final Remedial Investigation Report, Volumes I and II, and Appendix B Baseline Basewide Risk Assessment* (Geraghty & Miller, 1997)
- *Institutional Control Plan* (ARCADIS, 2000)
- *Luke Air Force Base General Plan* (Luke AFB, 2002)
- *Record of Decision Operable Unit 1* (USEPA, 1994)
- *Record of Decision Operable Unit 2* (USEPA, 1999)
- *Final Report Well Installation at Luke Air Force Base* (Tierra Dynamic, 2009)
- *Luke Air Force Base Long-Term Monitoring Workplan* (PIKA-Pirnie, 2009)
- *Luke Air Force Base Interim Annual Groundwater Monitoring Report* (PIKA-Pirnie, 2009)
- *Luke Air Force Base Interim Annual Radiation Monitoring Report* (PIKA-Pirnie, 2009)
- *Inspection of Concrete Cap, Site ST-18, Building 993, Luke AFB* (PIKA-Pirnie, 2009)

- *Luke Air Force Base Annual Groundwater Monitoring Report* (PIKA-Pirnie, 2010)
- *Luke Air Force Base Annual Radiation Monitoring Report* (PIKA-Pirnie, 2010)
- *Inspection of Concrete Cap, Site ST-18, Building 993, Luke AFB* (PIKA-Pirnie, 2010)
- *Luke Air Force Base Long-Term Monitoring Report* (PIKA-Pirnie, 2011)

### **7.1.3 Data Review**

Current groundwater and soil standards/criteria were compared to the chemical-specific applicable or relevant and appropriate requirements (ARARs) summarized in the OU-1 ROD (which were used for the Basewide risk assessment in 1997). These standards were used to assess if newly promulgated or modified standards affect the protectiveness of the remedy originally selected in the ROD. Appendix G presents the standards and criteria evaluated during the Basewide risk assessment and any updates made since 1977, as well as a comparison of toxicity values. The current standards are listed below:

- MCLs (revised 2011)
- PRGs, renamed to Regional Screening Levels (RSLs) (revised 2011)
- Arizona WQS (revised 2008)
- Arizona SRLs (revised 2007)

Since the RODs were promulgated, additional sampling at the site has consisted of the LTM program, which monitors groundwater at ST-18, SS-42, SD-20, FT-07E, and RW-02 for TPH and VOCs. Soil samples and inorganic parameters have not been analyzed during this five-year review time period. A summary of the groundwater data is included in Appendix D. Detected concentrations of VOCs continue to be below the AWQS and MCL screening levels. Changes in the soil screening levels (ADEQ SRLs and USEPA RSLs) or toxicity values do not impact the protectiveness of the selected remedies since the land restrictions continue to be in place.

### **7.1.4 Site Inspections**

Inspections at the PSCs were conducted during September 2011 by Alan Thomas (Restoration Program Manager, Luke AFB Environmental Flight) and Marla Miller (ARCADIS). The site inspection checklists from the Third Five-Year Review are provided as Appendix A. The purpose of the inspections is to assess the protectiveness of the remedy, including the presence of fencing to restrict access, the integrity of the cap at ST-18, the status of the land use restrictions, and the condition of the restricted areas.



No significant issues have been identified at any time regarding the fence, the cap at ST-18, or the restricted areas. The fencing at RW-02 was intact and well maintained. The annual ST-18 cap inspection reports are summarized in Appendix E.

The ICs that are in place include prohibitions on the use or disturbance of soil, excavation activities, disturbance of the cap, and any other activities or actions that might interfere with the implemented remedy. ICs were evaluated during the site visit. No activities were observed that would have violated the ICs. The cap at ST-18 and restricted areas were undisturbed, and no new land use was observed at any of the PSCs inspected.

#### **7.1.5 Interviews**

Interviews were conducted with Mr. Alan Thomas (Luke AFB, Restoration Program Manager), Mr. Jeff Rothrock (Luke AFB, Environmental Flight Chief), Mr. Cris Brownlo (Luke AFB, Community Planner), and Mr. Travis Barnum (ADEQ, Project Manager). The interviews are summarized in Appendix B.

## 8.0 TECHNICAL ASSESSMENT

This section discusses whether the remedies selected in the OU-1 and OU-2 RODs remain effective in protecting human health and the environment. The remedial objectives for the OU-1 and OU-2 sites were to be protective of human health and the environment, and to control exposure pathways that could result in unacceptable risk. The following sections evaluate the remedy for each site and assess its continued effectiveness in achieving these remedial objectives. Any new ARARs or additional information obtained since the Second Five-Year Review were reviewed for potential impacts affecting the protectiveness of the remedy. The evaluation was accomplished by reviewing relevant site documents and reports, revisiting the ARARs applied at the time of the remedy, evaluating risk assumptions, and considering the results of the site inspections.

### 8.1 Assessment of Site-Specific Remedies

Selected remedial actions for the OU-1 and OU-2 sites included soil treatment, source capping, long-term monitoring (for groundwater and gamma radiation) and ICs. ICs involving land use restrictions consisted of filing VEMURs with the county recorder or internal lands use restrictions prohibiting residential development, both of which are documented in the BGP. The BGP's constraints against residential development and construction are enforced through the use of AF Form 332, Civil Engineering Work request. The Form 332 is reviewed by a multi-disciplinary group that includes the Community Planner. The review process identifies potential conflicts that may require resolution before a task may proceed.

#### 8.1.1 DP-13: Drainage Ditch Disposal Area

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for DP-13 was ICs, based on the risk assessment determination that wastes were buried and posed no exposure threat assuming current land use scenarios. The site inspection verified that the land use at DP-13 has not changed. ICs consisting of land use restrictions prohibiting residential development are in place, including a VEMUR and documentation in the BGP and ICP, and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

Yes. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

This site is used for industrial purposes and future land use is not expected to change. The BGP precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The constituents observed at DP-13 included PAHs, TRPH, and metals, which are characterized by limited mobility and strong sorption to soils. Based on these characteristics and the depth of groundwater at Luke AFB, leaching to groundwater was not expected to be a concern. The remedy is still considered to be protective and ICs are adequate.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No.

### **8.1.2 FT-07E: Eastern Portion of North Fire Training Area**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for FT-07E was ICs, based on the risk assessment determination that wastes were buried and posed no exposure threat assuming current land use scenarios. After the First Five-Year Review, per ADEQ's request, monitoring wells at FT-07E were added to the long-term monitoring program. The site inspection verified that land use at FT-07E has not changed. ICs consisting of land use restrictions prohibiting residential development are in place, including a VEMUR and documentation in the BGP and ICP, and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

Yes. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil and groundwater ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

Groundwater samples are collected FT-07E every five years as part of the long-term groundwater monitoring program. Groundwater data indicate that VOCs have not been detected at levels above an ARAR since 1998. This site is used for industrial purposes and future land use is not expected to change. The arsenic concentrations reported in soil and groundwater were reported at naturally occurring levels and are not considered to be site related. The remedy is considered to be protective and the ICs are adequate.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No. VOCs and TPH were not detected in groundwater samples collected during May 2011 from monitoring wells MW-118-S and MW-123-S.

### **8.1.3 LF-03: Outboard Runway Landfill**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for LF-03 was ICs, based on the risk assessment determination that wastes were buried and posed no exposure threat assuming current land use scenarios. The site inspection verified that the land use at LF-03 has not changed. ICs consisting of land use restrictions prohibiting residential development are in place, including a VEMUR and documentation in the BGP and ICP, and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No.

### **8.1.4 LF-14: Old Salvage Yard Burial Site**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for LF-14 was ICs, based on the risk assessment determination that wastes were buried and posed no exposure threat assuming on current land use scenarios. The site inspection verified that the land use at LF-14 has not changed. ICs consisting of land use restrictions prohibiting residential development are in place, including a VEMUR and documentation in the BGP and ICP, and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

Yes. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No.

#### **8.1.5 LF-25: Northwest Landfill**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for LF-25 was excavation of contaminated soils, ex situ mechanical treatment of contaminated soils, on-site disposal of treated soils, and ICs. Lead shot was mechanically separated from the soil. The soil was tested before being returned to the site to assure that the action level of 400 mg/kg had been achieved. The site inspection verified that the land use at LF-25 has not changed. ICs consisting of land use restrictions prohibiting residential development are in place, including a VEMUR and documentation in the BGP and ICP, and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No. Material from the adjacent skeet range continues to fall on LF-25. The ICs consist of land use restrictions (VEMUR and constraints described in the BGP) and the use of PPE required during all future excavation activities at the site. The ICs exist to control worker's exposure during excavation at the site, not to prevent any ongoing impact to surface conditions from the adjacent skeet range, as such the remedy remains protective.

#### **8.1.6 RW-02: Wastewater Treatment Annex Landfill**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for RW-02 was ICs to prevent exposure to low-level radioactive wastes buried at the site, and monitoring for 30 years to assure that the integrity of the concrete burial vault has not been compromised and that groundwater has not been impacted.

Results of the down-hole radiological monitoring indicate that the concrete vault is functioning to contain the radioactive waste. Annual radiological results indicate readings commensurate with background levels. The ICs, in the form of security fencing and placarding, are in place. The site inspection verified that the land use at RW-02 has not changed. Land use restrictions prohibiting residential development are in place, including a VEMUR and documentation in the BGP and ICP.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil and groundwater ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

Groundwater samples are collected RW-02 every five years as part of the long-term groundwater monitoring program. Groundwater data indicate that VOCs have not been detected at levels above an ARAR since 1998. The remedy is considered to be protective and the ICs are adequate.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No. VOCs and TPH were not detected in groundwater samples collected during May 2011 from monitoring well MW-124-S. Gamma radiation results from the four monitoring points did not exceed the action level of twice the background detection. Gamma radiation at RW-02 is measured using a scintillation counter and probe calibrated against a Cesium 137 source and is reported as counts per minute (cpm). The average reading at RW-02 over the past 10 years has been approximately 13,000 cpm. This translates to a measured exposure rate of about 14.5 microRoentgen per hour (uR/hr), which is well within published range of background radiation exposure expected in this region and does not indicate any measurable increase due to the material entombed at RW-02.

### **8.1.7 SD-38: Oil/Water Separator at Auto Body Shop**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for SD-38 was ICs, based on the risk assessment determination that wastes were buried and there was no exposure threat assuming current land use scenarios. The site inspection at SD-38 verified that the land use has not changed. ICs consisting of land use restrictions prohibiting residential development are in place, including a VEMUR and documentation in the BGP and ICP, and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil and groundwater ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No.

#### **8.1.8 SS-42: Bulk Fuels Storage Area**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for SS-42 was installation and operation of an SVE system to remediate the soil source, then groundwater monitoring to confirm the effectiveness of the SVE system and groundwater quality. The SVE system was installed and operated under an interim removal action before the OU-1 ROD was signed, thereby nullifying the need for further action. Routine groundwater monitoring is conducted under the long-term groundwater monitoring program and data indicate that groundwater in the site vicinity has not been impacted. Land use restrictions prohibiting residential development are documented in the BGP. The remedy appears to be adequate for achieving remedial objectives.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil and groundwater ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

Monitoring wells at SS-42 are sampled annually for VOCs and TPH as part of the Luke AFB LTM program. None of the reported detections have exceeded a groundwater ARAR.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No. Low level concentrations (below the USEPA MCL and AWQS of 5.0 ug/L) of 1,2-dichloropropane were observed in monitoring wells MW-121-S and MW-125R-S during the May

2011 sampling event. During the last three annual monitoring events, 1,2-dichloropropane has been detected in SS-42 monitoring wells at concentrations ranging from 0.52 to 1.4 ug/L. Historically, 1,2-dichloropropane was used as a soil fumigant on a variety of crops, including citrus. Citrus orchards were previously located upgradient of the site.

#### **8.1.9 SD-20: Oil/Water Separator and Earth Fissure**

As previously described, SD-20 was assigned no further action status in the ROD and remedial alternatives were not required to be developed. Since SD-20 was added to the LTM program, the technical assessment questions were addressed to evaluate the site conditions.

***Question A: Is the remedy functioning as intended by the decision documents?***

Not applicable. Site SD-20 was considered a No Further Action site in the OU-1 ROD.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical condition that would affect the site under current land use scenarios. Changes in soil and groundwater ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

***Question C: Has there been other information been discovered that could impact the protectiveness of the remedy?***

No. Low level concentrations (below the USEPA MCL and AWQS) of 1,2-dichloroethane and TCE were observed in monitoring wells MW-113-S and MW-112S-S during the May 2011 sampling event. VOCs were not detected in the monitoring well MW-122D (screened in a deeper zone) and TPH was not detected in the SD-20 monitoring wells.

#### **8.1.10 ST-18: Former Liquid Waste Storage Facility**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. The selected remedy for ST-18 specified in the OU-2 ROD was capping, ICs, and groundwater monitoring. The site was capped with a concrete runway in 1997 as part of RCRA closure requirements before the OU-2 ROD was signed. Because the cap recommended in the ROD was already in place, this component of the remedy was not implemented. The cap is inspected annually to assure its integrity and repairs are made as needed. A summary of the cap inspections since the Second Five-Year Review Report is presented in Appendix E. Annual



groundwater monitoring is conducted at ST-18 under the long-term groundwater monitoring program.

The site inspection at ST-18 verified that the land use has not changed. ICs consisting of land use restrictions prohibiting residential development are in place, including documentation in the BGP and ICP, and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil and groundwater ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

Monitoring wells at ST-18 are sampled annually for VOCs and TPH under the Luke AFB LTM program. During the last three monitoring events, samples have not been detected for VOCs and TPH.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

VOCs and TPH were not detected in groundwater samples collected during May 2011 from monitoring wells MW-114-S and MW-122-S.

Cracks in the concrete cap have been noted during the inspections and several generations of repairs have been made to seal cracks in the concrete cap. During the next five-year review, the Base will perform a formal analysis to evaluate the costs and benefits of continued maintenance versus replacement of the cap. The evaluation will be performed by a third-party consultant with specific expertise in concrete slabs.

#### **8.1.11 DP-23: Old Surface Impoundment West of Facility 993**

***Question A: Is the remedy functioning as intended by the decision documents?***

Yes. DP-23 was divided into the southern portion and the northern portion. The remedy for the southern portion was excavation, ex situ soil treatment via composting, on-site disposal of treated soils, then subsequent monitoring. Based on the findings of the risk assessment, the remedy for the northern portion of DP-23 was ICs. The site inspection verified that land use at DP-23 has not changed. ICs consisting of land use restrictions prohibiting residential development are in place (as documented in the BGP and ICP), and are protective.

***Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?***

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Changes in soil ARARs or toxicity values do not affect the protectiveness of the remedy. The exposure assumptions, developed during the Basewide risk assessment, have not changed.

***Question C: Has any other information been discovered that could impact the protectiveness of the remedy?***

No.

## **8.2 Technical Assessment Summary**

According to the data reviewed, site inspections, and interviews, the site remedies function as intended in the OU-1 and OU-2 RODs. There have been no changes in the physical condition or land usage at the sites. Though some of the ARARs for the COCs at the OU-1 and OU-2 sites have changed since the remedial action and since the last Five-Year Review, the cleanup accomplished under the RODs are still protective under current land use scenarios. The OU-1 and OU-2 sites remain protective of human health and the environment and exposure pathways that could result in unacceptable risks are controlled through ICs and LTM.

## 9.0 ISSUES

Issues identified during the technical assessment of OU-1 and OU-2 sites do not affect current protectiveness of human health and the environment but rather were items requiring evaluation to ensure future protectiveness. These issues are described below:

- **Rising Groundwater Elevations:** Since the early 1980s, groundwater elevations have increased at rates up to 5 feet per year. The increasing groundwater elevation could eventually cause contaminants present in the unsaturated zone to leach into groundwater. As of 2011, the Base groundwater elevation was approximately 240 feet bgs. The deepest detections greater than ARARs were observed at 141 feet bgs (at SS-42).
- **Condition of the ST-18 Concrete Cap:** ST-18 was capped with concrete airfield pavement as part of the RCRA post-closure requirements. The cap was installed as a means to control access to, and contaminant migration from, soils that may have been impacted by releases from three former USTs. According to the design data, the cap consists of a 30-millimeter HDPE liner covered by six inches of aggregate base, and a nine-inch thick reinforced concrete cap. Repairs of cracks in the cap have been performed in the past and have been used to successfully preserve the cap integrity. During the next five-year review period, the Base will perform an analysis to evaluate the costs and benefits of continued maintenance versus replacement of the concrete cap.
- **Action Levels for Gamma Radiation Monitoring:** In the OU-1 ROD, the action level for gamma radiation monitoring at RW-02 is defined as twice the background level. ADEQ has expressed concern in the past about the appropriateness of establishing the action level this way, as it provides a potentially variable standard.
- **Ongoing Operations at Skeet Range Adjacent to LF-25:** Material from the adjacent skeet range continues to fall on LF-25. The remedy of ICs controls exist to control a worker's exposure during excavation at the site, not to prevent any ongoing impact to surface conditions from the adjacent skeet range. The remedy continues to be protective in controlling uncontrolled excavation at the site. However, the remedy was selected based on an assessment of surface conditions at LF-25 several years ago. During the next five-year review period, the Base will revalidate surface conditions at LF-25.
- **Updating the ICP and BGP:** The BGP and ICP contain information concerning land use restrictions for the relevant OU-1 and OU-2 sites. The most current version of the ICP is dated 2000 and the BGP is dated 2002.

## 10.0 RECOMMENDATIONS / FOLLOW-UP ACTIONS

Table 20 summarizes the issues identified during the Third Five-Year Review and the recommended corrective action. The responsible party for all recommended follow-up actions is Luke AFB, and both ADEQ and USEPA are the regulatory oversight/approval agencies.

<b>Table 20</b> <b>Recommendations/Follow-Up Actions Summary</b>				
<b>Issues</b>	<b>Actions</b>	<b>Scheduled Date</b>	<b>Affects Current Protectiveness (Y/N)</b>	<b>Affects Future Protectiveness (Y/N)</b>
Rising Groundwater Elevations	Continue to monitor water levels annually at ST-18 and SS-42	Next monitoring event is May 2012	N	Y
Cracks in ST-18 Concrete Cap	Cap inspected on annual basis; continue to repair cracks with silicone sealant	Assess need for additional repairs after next cap inspection (May 2012)	N	Y
	Perform analysis to evaluate costs and benefits of continued maintenance vs. cap replacement	Apply for funding in fiscal year 2013, anticipate performing analysis in 2014	N	Y
Action Levels for Gamma Radiation Monitoring	Work with ADEQ to assess appropriateness of current action level	Prior to next monitoring event (May 2012)	N	N
Impact at LF-25 from Adjacent Skeet Range	Revalidate surface conditions at LF-25	Apply for funding in fiscal year 2013, anticipate performing analysis in 2014	N	N
ICP and BGP	Update ICP and BGP to include land use restrictions for appropriate OU-1 and OU-2 sites	BGP will be updated within one year and the ICP will be updated within two years of finalizing the Third Five-Year Review Report	N	Y

## **11.0 PROTECTIVENESS STATEMENTS**

The remedies at OU-1 and OU-2 currently protect human health and the environment because the exposure pathways that could result in unacceptable risks are being controlled by ICs and LTM. Because the remedial actions at the OU-1 and OU-2 sites are protective, the site is protective of human health and the environment.

Long-term protectiveness of the removal and remedial actions will be verified through continued LTM to evaluate the potential migration of contamination from the vadose zone to the groundwater. Additional sampling and analysis will be completed annually at SS-42 and ST-18 and every fifth year at FT-07E, RW-02, and SD-20.

## **12.0 NEXT FIVE-YEAR REVIEW**

The next Five-Year Review for the Luke AFB OU-1 and OU-2 sites will be performed during 2017.

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PIKA-Pirnie, 2010. Luke Air Force Base Annual Groundwater Monitoring Report, September 2010

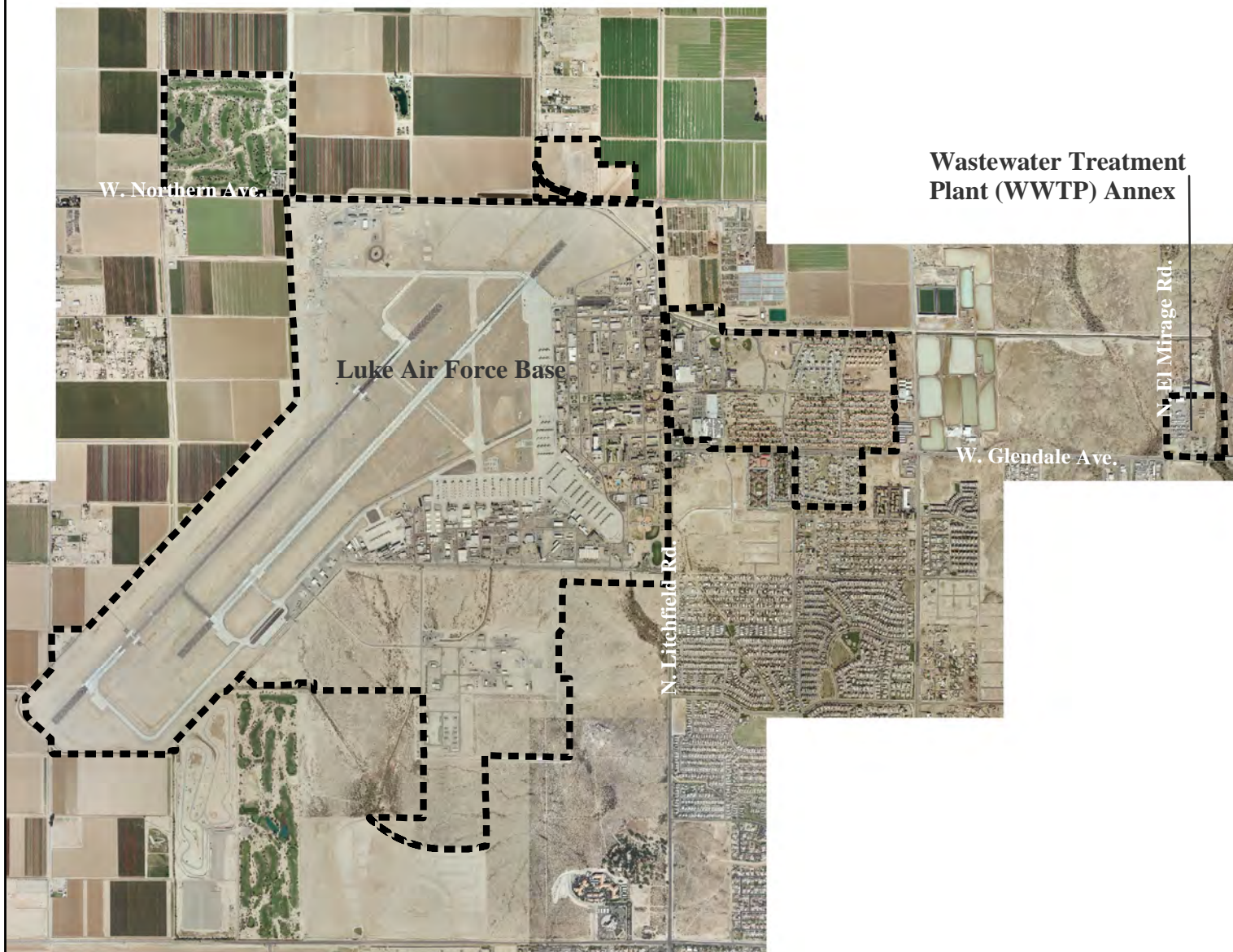
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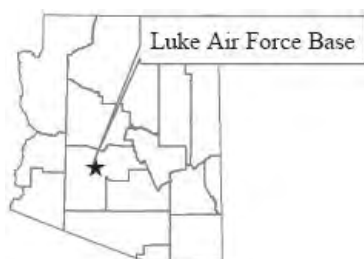
PIKA-Pirnie, 2011. Luke Air Force Base Long-Term Monitoring Report, September 2011

Tierra Dynamic, 2009. Final Report Well Restoration at Luke Air Force Bases, Arizona, January 20, 2009.





Note: Aerial photos from Maricopa County.



Site Location Map  
Third Five-Year Review Report

Luke Air Force Base

July 2012

**Figure 1**






0 0.5 1 Miles

Note: Aerial photos from Maricopa County.

### Legend:

All locations are approximate

 Potential Sources of Contamination (PSCs)

SS-42 = Bulk Fuel Storage Area  
ST-18 = Former Liquid Waste Storage Facility  
FT-07E = Eastern Portion of North Fire Training Area  
SD-20 = Oil/Water Separator Canal and Earth Fissures  
RW-02 = Wastewater Treatment Plant (WWTP) Annex  
SD-38 = Oil/Water Separator at Auto Body Shop  
DP-13 = Drainage Ditch Disposal Area  
LF-03 = Outboard Runway Landfill  
LF-25 = Northwest Landfill  
DP-23 = Old Surface Impoundment West of Facility 993  
LF-14 = Old Salvage Yard Burial Site



## Facility Layout Third Five-Year Review Report

Luke Air Force Base

July 2012

**Figure 2**





Note: Aerial photos from Maricopa County.



DP-13 Site Map  
Third Five-Year Review Report

Luke Air Force Base

July 2012

**Figure 3**





Note: Aerial photos from Maricopa County.

## Legend

● Monitoring Wells

Site	Well ID	Date Collected	Volatile Organics (ug/L)							TPH (mg/L)	
			Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	1,2-DCP	TCE	Diesel Range	Gasoline Range
FT-07E	MW-118-S	5/11/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20
		7/15/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10
	MW-123-S	5/11/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20
		7/15/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10

### Notes:

ug/L = micrograms per liter; mg/L = milligrams per liter; AWQS = Aquifer Water Quality Standards  
 1,2-DCP = 1,2-Dichloropropane; 1,2-DCA = 1,2-Dichloroethane; TCE = Trichloroethene; TPH - Total Petroleum Hydrocarbons  
 "<" = Analyte not detected above the listed reporting limit; Bolded values = Results detected above reporting limit



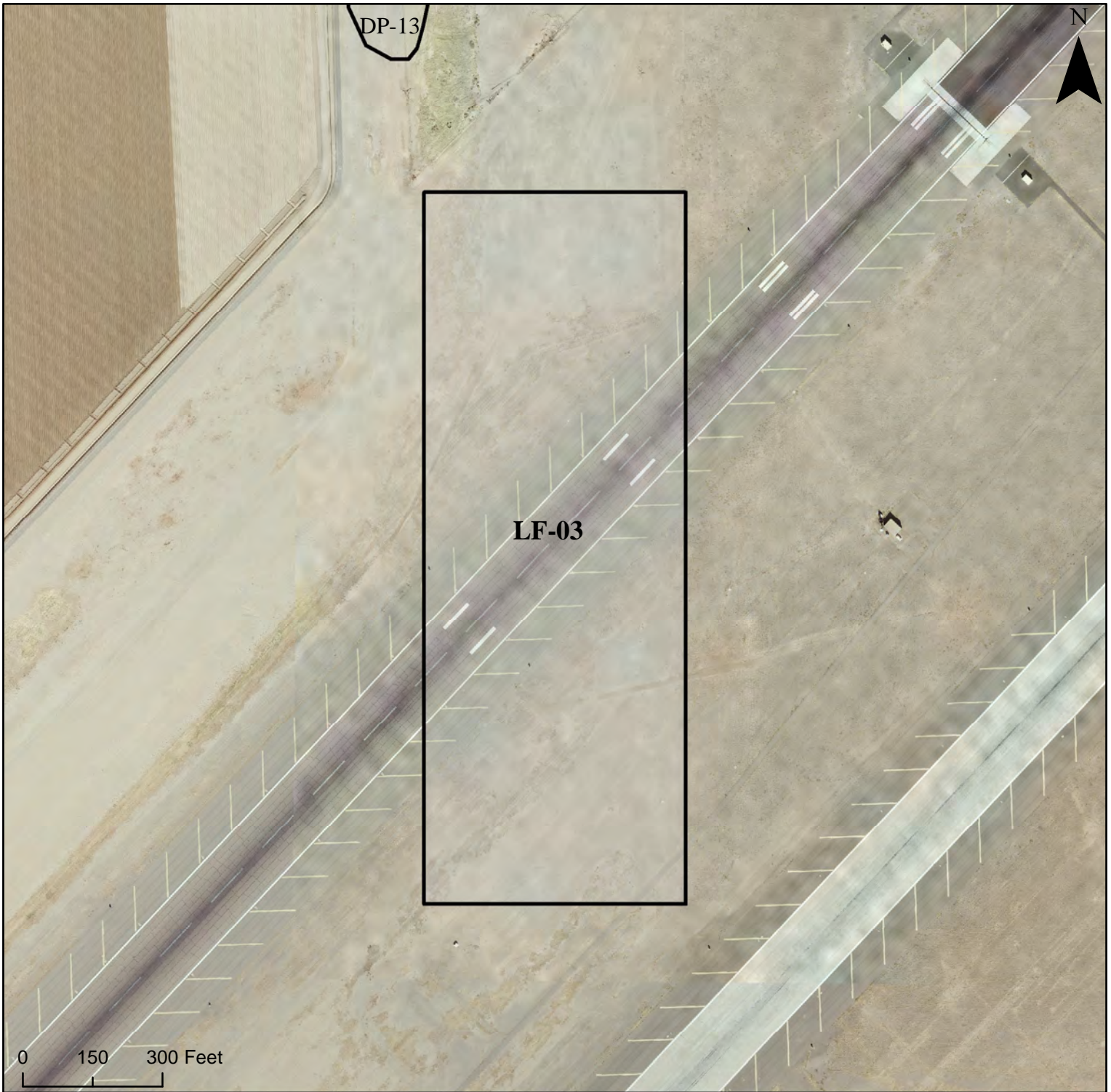
## FT-07E Site Map Third Five-Year Review Report

Luke Air Force Base



July 2012

**Figure 4**






Note: Aerial photos from Maricopa County.

 	
LF-03 Site Map Third Five-Year Review Report  Luke Air Force Base	
July 2012	<b>Figure 5</b>

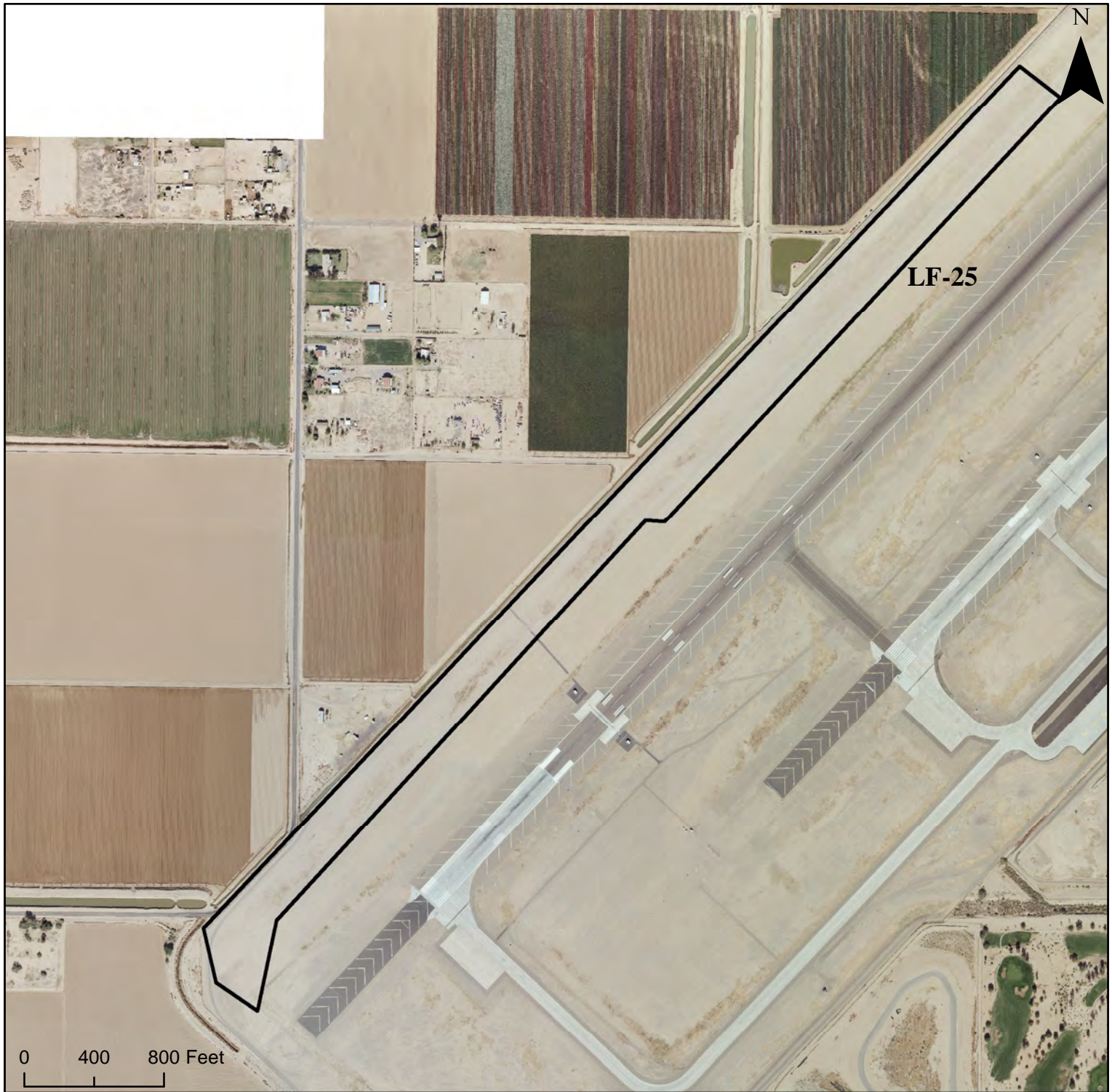




Note: Aerial photos from Maricopa County.

 	
LF-14 Site Map Third Five-Year Review Report  Luke Air Force Base	
July 2012	<b>Figure 6</b>





Note: Aerial photos from Maricopa County.



LF-25 Site Map  
Third Five-Year Review Report

Luke Air Force Base

July 2012

**Figure 7**





Note: Aerial photos from Maricopa County.

RW-02 is located at the Wastewater Treatment Plant annex north of Glendale Avenue, approximately 2 miles east of Luke Air Force Base.

### Legend:

All locations are approximate

● Gamma Radiation Monitoring Points

● Gamma Radiation Background Monitoring Points



● Monitoring Wells

□ RW-02

Site	Well ID	Date Collected	Volatile Organics (ug/L)							TPH (mg/L)	
			Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	1,2-DCP	TCE	Diesel Range	Gasoline Range
		AWQS	5.0	1,000	700	10,000	5.0	5.0	5.0	NA	NA
RW-02	MW-124-S	5/11/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20
		7/11/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10

#### Notes:

ug/L = micrograms per liter; mg/L = milligrams per liter; AWQS = Aquifer Water Quality Standards  
 1,2-DCP = 1,2-Dichloropropane; 1,2-DCA = 1,2-Dichloroethane; TCE = Trichloroethene; TPH - Total Petroleum Hydrocarbons  
 "<" = Analyte not detected above the listed reporting limit; Bolded values = Results detected above reporting limit

RW-02 Site Map  
Third Five-Year Review Report

Luke Air Force Base

July 2012

**Figure 8**





Note: Aerial photos from Maricopa County.



SD-38 Site Map  
Third Five-Year Review Report

Luke Air Force Base

July 2012

Figure 9





Note: Aerial photos from Maricopa County.

## Legend

- Monitoring Wells

Site	Well ID	Date Collected	Volatile Organics (ug/L)							TPH (mg/L)	
			Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	1,2-DCP	TCE	Diesel Range	Gasoline Range
		AWQS	5.0	1,000	700	10,000	5.0	5.0	5.0	NA	NA
ST-42	MW-125R-S	5/9/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<b>0.88</b>	<0.50	<0.10	<0.20
		5/10/2011	<0.50	<0.50	<0.50	<0.10	<0.50	<b>1.4</b>	<0.50	<0.10	<0.20
		5/19/2009	<0.50	<0.50	<0.50	<0.10	<0.50	<b>0.69</b>	<0.50	<0.10	<0.20
		7/14/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10
	MW-121-S	5/9/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<b>1.4</b>	<0.50	<0.10	<0.20
		5/10/2011	<0.50	<0.50	<0.50	<0.10	<0.50	<b>0.52</b>	<0.50	<0.10	<0.20
		5/19/2009	<0.50	<0.50	<0.50	<0.10	<0.50	<b>0.79</b>	<0.50	<0.10	<0.20
		7/14/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10

Notes:  
 ug/L = micrograms per liter; mg/L = milligrams per liter; AWQS = Aquifer Water Quality Standards  
 1,2-DCP = 1,2-Dichloropropane; 1,2-DCA = 1,2-Dichloroethane; TCE = Trichloroethene; TPH - Total Petroleum Hydrocarbons  
 "<" = Analyte not detected above the listed reporting limit; Bolded values = Results detected above reporting limit



## SS-42 Site Map Third Five-Year Review Report

Luke Air Force Base

July 2012

Figure 10





Note: Aerial photos from Maricopa County.

## Legend

● Monitoring Wells    - - - Earth Fissure    [ ] Base Boundary

Site	Well ID	Date Collected	Volatile Organics (ug/L)							TPH (mg/L)	
			Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	1,2-DCP	TCE	Diesel Range	Gasoline Range
ST-20	MW-113-S	AWQS	<b>5.0</b>	<b>1,000</b>	<b>700</b>	<b>10,000</b>	<b>5.0</b>	<b>5.0</b>	<b>5.0</b>	NA	NA
		5/10/2011	<0.50	<0.50	<0.50	<1.5	<b>0.67</b>	<0.50	<b>0.65</b>	<0.10	<0.20
	MW-112S-S	7/16/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10
		5/12/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<b>1.5</b>	<0.10	<0.20
	MW-112D	7/16/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<b>1.1</b>	<0.10	<0.10
		5/12/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20
	MW-112S	7/16/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.11	<0.10

Notes:  
 ug/L = micrograms per liter; mg/L = milligrams per liter; AWQS = Aquifer Water Quality Standards  
 1,2-DCP = 1,2-Dichloropropane; 1,2-DCA = 1,2-Dichloroethane; TCE = Trichloroethene; TPH - Total Petroleum Hydrocarbons  
 "<" = Analyte not detected above the listed reporting limit; Bolded values = Results detected above reporting limit



## SD-20 Site Map Third Five-Year Review Report

Luke Air Force Base

July 2012

Figure 11





Note: Aerial photos from Maricopa County.

## Legend

● Monitoring Wells

Site	Well ID	Date Collected	Volatile Organics (ug/L)							TPH (mg/L)	
			Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	1,2-DCP	TCE	Diesel Range	Gasoline Range
ST-18	MW-114-S	AWQS	5.0	1,000	700	10,000	5.0	5.0	5.0	NA	NA
		5/9/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20
		5/10/2011	<0.50	<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.10	<0.20
		5/19/2009	<0.50	<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.10	<0.20
	MW-122-S	7/14/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<b>0.51</b>	<0.10
		5/9/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20
		5/10/2011	<0.50	<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.10	<0.20
		5/19/2009	<0.50	<0.50	<0.50	<0.10	<0.50	<0.50	<0.50	<0.10	<0.20
		7/14/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10

Notes:  
 ug/L = micrograms per liter; mg/L = milligrams per liter; AWQS = Aquifer Water Quality Standards  
 1,2-DCP = 1,2-Dichloropropane; 1,2-DCA = 1,2-Dichloroethane; TCE = Trichloroethene; TPH - Total Petroleum Hydrocarbons  
 "<" = Analyte not detected above the listed reporting limit; Bolded values = Results detected above reporting limit



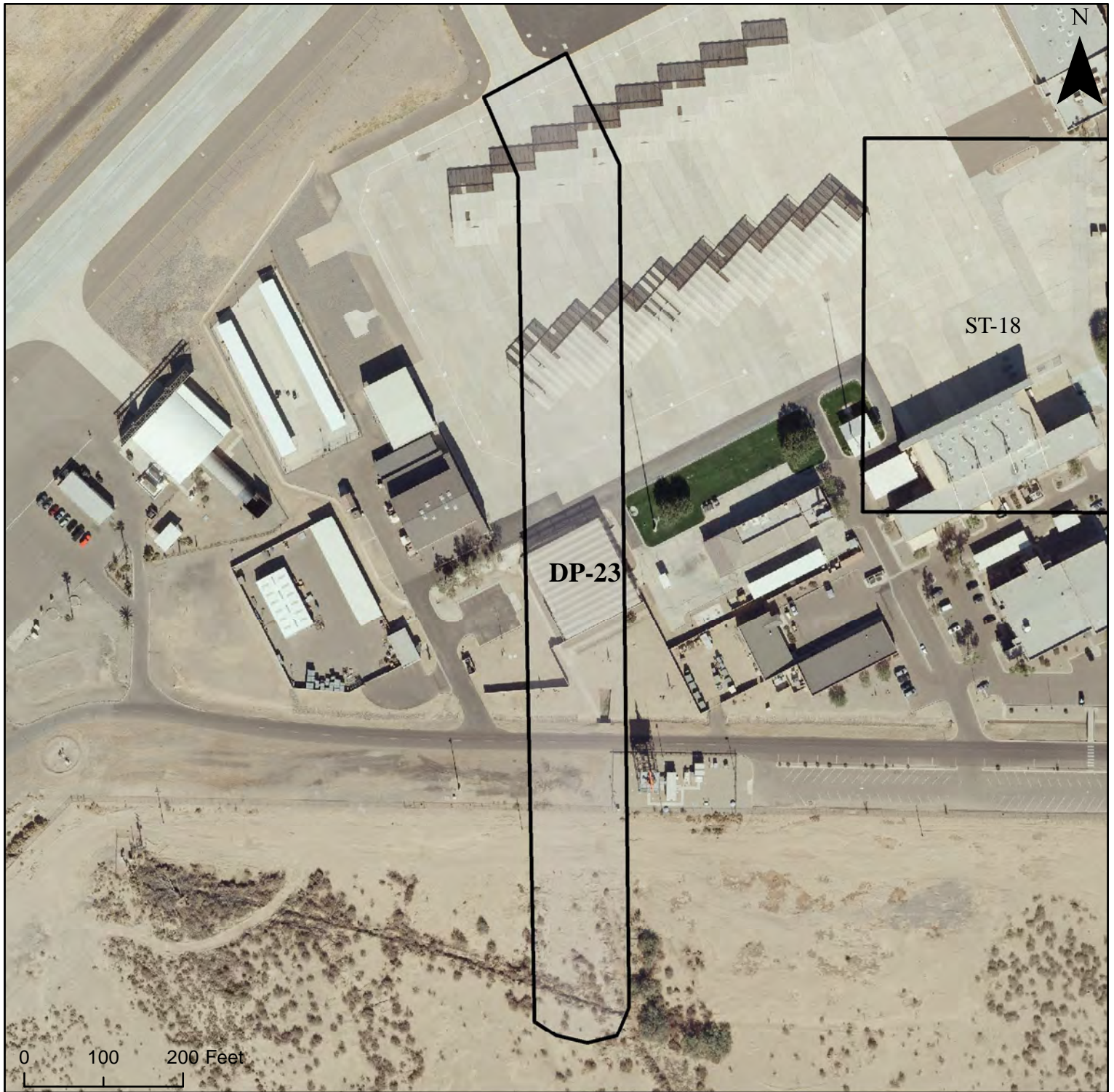
## ST-18 Site Map Third Five-Year Review Report

Luke Air Force Base

July 2012

Figure 12





Note: Aerial photos from Maricopa County.



DP-23 Site Map  
Third Five-Year Review Report

Luke Air Force Base

July 2012

**Figure 13**

**Appendix A**

**Site Inspection Forms**

### Five-Year Review Site Inspection Checklist

<b>1. SITE INFORMATION</b>	
Site Name: <b>DP-13 Drainage Ditch Disposal Area</b>	Inspection Dates: 9/1/2011 and 9/8/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: sunny
Remedy Includes: Institutional Controls	
Attachments: See attached photos	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, signed VEMUR to restrict future use to non-residential; DP-13 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Abandoned well located at south end of the site; north end of site is used for Antiterrorism Security Operations (ATSO) for preparedness training	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure	



DP-13: Abandoned well at south end of site



DP-13: At south end looking north



DP13: North portion used for Antiterrorism Security Operations (ATSO) training



<b>1. SITE INFORMATION</b>	
Site Name: <b>FT-07E Eastern Portion of North Fire Training Area</b>	Inspection Date: 9/1/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls and long-term monitoring	
Attachments: None	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable; SVE system operated from April 1992 to December 1992.	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, signed VEMUR to restrict future use to non-residential; FT-07E is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Active fire training pits are no longer in the eastern portion of FT-07E; monitoring wells are located within fenced area containing propane tank; new monitoring wells were installed in 2008	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable; groundwater monitoring wells MW-118-S and MW-123-S sampled every 5 years	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure	



FT-07E: Monitoring well near propane tank at FT-07E



FT-07E: Looking east near the FT-07E monitoring wells.

<b>1. SITE INFORMATION</b>	
Site Name: <b>LF-03 Outboard Runway Landfill</b>	Inspection Date: 9/1/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls	
Attachments: See attached photos	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, signed VEMUR to restrict future use to non-residential; LF-03 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Site is partially covered by runway.	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure	



LF-03: Runway covers part of site,  
no clear indication/delineation of  
site boundaries.

<b>1. SITE INFORMATION</b>	
Site Name: <b>LF-14 Old Salvage Yard Burial Site</b>	Inspection Date: 9/1/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls	
Attachments: See attached photos	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, signed VEMUR to restrict future use to non-residential; LF-14 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
No visible debris; black wall separates site from Northern Avenue and Litchfield Road.	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure	



LF14: Looking east  
towards northeast corner  
of Base



LF-14: Corner of  
Northern Avenue and  
Litchfield Road



LF-14: Looking west  
parallel to Northern  
Avenue.

<b>1. SITE INFORMATION</b>	
Site Name: <b>LF-25 Northwest Landfill</b>	Inspection Date: 9/1/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls	
Attachments: See attached photos	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, signed VEMUR to restrict future use to non-residential; LF-25 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Site is adjacent to active Base Skeet Shooting Range; some debris from range was observed during site inspection.	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure	



LF-25: Looking northeast, site access road has been recently repaved



LF-25: Looking southwest, down dirt access road.



LF-25: Example of material from adjacent Base Skeet Shooting Range.



<b>1. SITE INFORMATION</b>	
Site Name: <b>RW-02 Wastewater Treatment Annex Landfill</b>	Inspection Date: 5/9/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls and long-term monitoring	
Attachments: None	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, signed VEMUR to restrict future use to non-residential; RW-02 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Monitoring wells were replaced in 2008; fencing around low level radiological burial site and dry monitoring wells are in good shape; RV storage fencing has moved north; now access burial site through secured RV storage gate.	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable; groundwater monitoring well MW-124-S sampled every 5 years; monitoring points around radiological burial site monitored annually	
<b>10. OTHER REMEDIES</b>	
Low level radiological waste encased in concrete and buried in 122-foot pit, covered with 4 feet of concrete and 6 feet of soil	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure; radiation measurements have not exceeded the calculated action levels.	



RW-02: Institutional controls at radioactive waste burial area.



RW-02: Area near monitoring wells at RW-02



RW-02: Looking northwest at monitoring wells at RW-02

<b>1. SITE INFORMATION</b>	
Site Name: <b>SD-20 Oil/Water Separator Canal and Earth Fissures</b>	Inspection Date: 9/1/2011 and 9/8/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional control and long-term monitoring	
Attachments: See attached photos	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, SD-20 is listed in Base General Plan and Institutional Control Plan to restrict future development to non-residential; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Heavy vegetation located within drainage channel and surrounding monitoring wells; now monitoring wells were installed in 2008.	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure.	



SD-20: Beginning of drainage channel, culvert on north side of Super Sabre.



SD-20: Culvert on south side of Super Sabre.



SD-20: Near Ammo Country administrative building.





SD-20: North end of  
drainage channel



SD-20: Example of  
vegetation lining side of  
drainage channel



SD-20: Looking north  
towards Base



SD-20: Example of cracks  
in hardpan



SD-20: Example of  
vegetation.



SD-20: Standpipe  
monitoring well and  
ballards





SD-20: Earth fissure  
located at south end of  
drainage channel



SD-20: Southern end of  
drainage channel



SD-20: Earth fissure  
located at south end of  
drainage channel

<b>1. SITE INFORMATION</b>	
Site Name: <b>SD-38 Oil/Water Separator at Auto Body Shop</b>	Inspection Date: 9/1/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls	
Attachments: None	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, signed VEMUR to restrict future use to non-residential; SD-38 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Site is basically in middle of street where old Auto Shop used to be; oil/water separator was removed in 1991	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure.	





SD-38: Looking across street to location of the former auto body shop



SD-38: Monitoring well by site SD-38.

<b>1. SITE INFORMATION</b>	
Site Name: <b>SS-42 Bulk Fuels Storage Area</b>	Inspection Date: 5/9/2011 and 9/1/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls and long-term monitoring	
Attachments: None	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-1 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, SS-42 is listed in Base General Plan and Institutional Control Plan to restrict future development to non-residential; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Secondary containment around bulk storage tanks is in good shape; before sampling these monitoring wells, need to check in at administrative building and meet escort; new monitoring wells installed in 2008	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable; groundwater monitoring wells MW-121-S and MW-125R-S sampled annually	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure.	



SS-42: Bulk fuels storage facility with secondary containment around the aboveground storage tanks



SS-42: Monitoring wells at site SS-42

<b>1. SITE INFORMATION</b>	
Site Name: <b>DP-23 Old Surface Impoundment West of Facility 993</b>	Inspection Date: 9/1/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional control	
Attachments: See attached photos	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-2 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable; on-site treatment cell operated in 1995; no ongoing active remediation	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, DP-23 is listed in Base General Plan and Institutional Control Plan to restrict future development to non-residential use; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Concrete drainage culvert by ST-18; contained minimal debris	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable	
<b>10. OTHER REMEDIES</b>	
Not applicable	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure.	

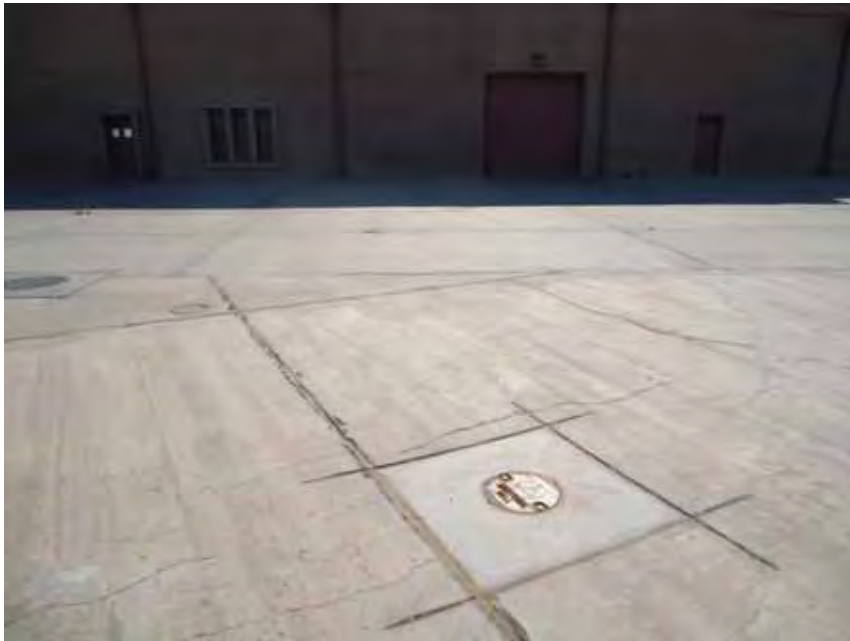


DP-23: Drainage channel near  
DP-13 area.

<b>1. SITE INFORMATION</b>	
Site Name: <b>ST-18 Former Liquid Waste Storage Facility (Facility 993)</b>	Inspection Date: 5/9/2011
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny
Remedy Includes: Institutional controls and long-term monitoring	
Attachments: None	
<b>2. INTERVIEWS</b>	
Alan Thomas, Restoration Manager, CES/CEAN	
<b>3. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b>	
Not applicable; site described in OU-2 ROD	
<b>4. O&amp;M COSTS</b>	
Not applicable	
<b>5. ACCESS &amp; INSTITUTIONAL CONTROLS</b>	
Basewide security, area itself is fenced, ST-18 is listed in Base General Plan and Institutional Control Plan to restrict future development to non-residential; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager	
<b>6. GENERAL SITE CONDITIONS</b>	
Minor hairline cracks observed in the concrete cap will be continued to be monitored during annual inspections; new monitoring wells installed in 2008.	
<b>7. LANDFILL COVERS</b>	
Not applicable	
<b>8. VERTICAL BARRIER WALLS</b>	
Not applicable	
<b>9. GROUNDWATER/SURFACE WATER REMEDIES</b>	
Not applicable; groundwater monitoring wells MW-114-S and MW-122-S sampled annually	
<b>10. OTHER REMEDIES</b>	
ST-18 was capped with concrete in 1987; concrete cap is inspected annually	
<b>11. OVERALL OBSERVATIONS</b>	
Institutional controls are in place and appear to be effective in controlling site access and exposure.	



ST-18: Monitoring well at ST-18 area, looking towards Bldg 993



ST-18: Monitoring well by concrete cap at ST-18 area.

## **Appendix B**

### **Interview Questionnaires**



### Five-Year Review Interview Records

SITE INFORMATION	
Site Name: Luke AFB	Date: September – December 2011
Individual Contacted: Alan Thomas	Title: Restoration Program Manager, CES/CEAN
Interviewer: Marla Miller (ARCADIS)	Type of Interview: In person
SUMMARY OF CONVERSATION	
<p>Alan has been involved at the Base since 1986, leaving in 1991 but returning as Water Program Manager in December 2004. In July 2005 he became Restoration Program Manager. He wasn't involved during the First Five-Year Review (2002) but was involved with the Second Five-Year Review (2007).</p> <p>Changes that have occurred since the Second Five-Year Review include:</p> <ul style="list-style-type: none"><li>• Installation of new wells at sites ST-18, SS-42, SD-20, FT-07E, and RW-02 (the new wells were installed since the increasing groundwater elevation resulted in submerged well screen intervals)</li><li>• Additional repairs to the concrete cap at ST-18 (January 2009 and December 2010)</li><li>• Extended the RV parking area at RW-02 (now have to access low level radiological burial site through RV parking security gate)</li></ul> <p>During the September 2011 site inspections, Alan explained the past history and current status of the sites, as well as background on the Luke AFB RODs and documents in the administrative record.</p>	

SITE INFORMATION	
Site Name: Luke AFB	Date: 12/8/2011
Individual Contacted: Jeff Rothrock	Title: Chief, Environmental CES/CEAN
Interviewer: Marla Miller (ARCADIS)	Type of Interview: Phone
SUMMARY OF CONVERSATION	
<p>1) <i>What is your overall impression of the project?</i> Excellent, the project has gone very smoothly, it continues to be important to make sure that all of the remedies are functioning properly</p> <p>2) <i>Are the remedies functioning as expected?</i> Yes, the institutional controls are working as anticipated and the AF Form 332 acts as a safeguard to ensure future development at the sites continues to be non-residential</p> <p>3) <i>What does the monitoring data show?</i> Annual groundwater monitoring do not show signs of increasing concentrations; however, groundwater elevations are increasing</p> <p>4) <i>Is there a continuous on-site O&amp;M presence?</i> No active O&amp;M; just long-term monitoring (groundwater, radiological, and cap inspection) and institutional controls</p> <p>5) <i>Have there been any significant changes in the O&amp;M requirements, monitoring schedules, or sampling routines?</i> No changes to schedule since the last five-year review; continue to perform annual cap inspection and schedule repairs as needed so see no need to change schedule</p> <p>6) <i>Have there been any unexpected O&amp;M difficulties?</i> No</p> <p>7) <i>Are there any opportunities to optimize O&amp;M or sampling efforts?</i> None currently identified; will continue to monitor increasing groundwater levels</p> <p>8) <i>Any comments, suggestions, or recommendations regarding the project?</i> Luke AFB is the preferred alternate location for the F-35 training mission; the environmental impact statement did not identify any significant impacts to the current project; will need to continue to monitor sites to ensure remedies remain protective</p> <p>9) <i>Is there any current community involvement?</i> Luke AFB maintains strong partnerships with West Valley cities through the Luke West Valley Council</p>	

SITE INFORMATION	
Site Name: Luke AFB	Date: May 29, 2012
Individual Contacted: Cris Brownlo	Title: Chief, Asset Optimization
Interviewer: Marla Miller (ARCADIS)	Type of Interview: Phone
SUMMARY OF CONVERSATION	
<p>Mr. Brownlo also acts as Community Planner at the Base and is involved with planning, real estate, and energy. As Community Planner, he is involved with siting new facilities, airfield waivers, general development, and during the initial project development. In addition to the AF Form 332, AF Form 813 presents a checklist of environmental constraints that must be identified and assessed before a project is initiated. The AF Form 813 is generated by the project proponent and is reviewed by planner, environmental staff (Alan and Jeff), legal, and programmers. Temporary facilities also go through this approval process.</p> <p>He has not heard of any issues or concerns form community members for the last 5 to 10 years.</p> <p>The combination of AF Forms, BGP, ICP, and the review process act as protection to ensure that the land restrictions are maintained throughout the Base.</p>	

SITE INFORMATION	
Site Name: Luke AFB	Date: May 29, 2012
Individual Contacted: Travis Barnum	Title: Project Manager, ADEQ
Interviewer: Marla Miller (ARCADIS)	Type of Interview: Phone
SUMMARY OF CONVERSATION	
<p>Mr. Barnum has been involved with the Luke AFB project for nine months but is supported by several ADEQ staff (Brian Stonebrink, Wade Miller, etc) who have been involved with the project for many years.</p> <p>1) <i>What is your overall impression of the project?</i> Project seems to be going very well, very thorough and smooth remediation process</p> <p>2) <i>Are the remedies functioning as expected?</i> Remedies appear to be working fine. We discussed the gamma monitoring at RW-02 and Travis commented that it was more of a statistical issue rather than a health concern</p> <p>3) <i>What does the monitoring data show?</i> No concerns with results of the annual groundwater monitoring other than keeping an eye on the rising groundwater elevations</p> <p>4) <i>Is there a continuous on-site O&amp;M presence?</i> Yes if O&amp;M is defined as continued site inspections and annual monitoring (no if O&amp;M is defined as operation and maintenance for active remediation techniques)</p> <p>5) <i>Have there been any significant changes in the O&amp;M requirements, monitoring schedules, or sampling routines?</i> Not really. We discussed the addition of FT-07E wells to the long-term monitoring program and the installation of new wells with shallower screens but Travis didn't feel that these represented "significant" changes</p> <p>6) <i>Have there been any unexpected O&amp;M difficulties?</i> Not that Travis is aware of.</p> <p>7) <i>Are there any opportunities to optimize O&amp;M or sampling efforts?</i> We talked about the pros and cons of shifting groundwater monitoring techniques (e.g., using HydroSleeves) but came back to the idea that it didn't make technical or financial sense to shift techniques – keep going with current sampling efforts</p> <p>8) <i>Any comments, suggestions, or recommendations regarding the project?</i> Not really. Travis commented on how many VEMURs were in place at the Base, discussed pros/cons of trying to combine sites and potential problems with trying to close areas. All big things start off small</p> <p>9) <i>Is there any current community involvement?</i> Not that Travis is aware of</p>	

## **Appendix C**

### **Summary of Gamma Radiation Monitoring at RW-02**

## **C1.0        Gamma Radiation Monitoring Procedures**

Gamma radiation is monitored annually as part of the Luke AFB long-term monitoring program at the PSC RW-02. Measurements were collected from the four existing vadose zone (dry) monitor points (MP-1 through MP-4) and one background location (BG-1). Surface background measurements were also collected prior to, and after, the completion of the radiation monitoring at a location approximately 20 feet northeast of monitoring point BG-1. From 2000 to 2005 and 2009 to 2011, a Ludlum Model 2221 portable scaler/ratemeter and a Ludlum Model 44-10 scintillator probe were used to collect measurements. In 2006 and 2008, a Model 44-20 probe was used for gamma radiation monitoring. The Model 44-20 scintillator probe has a greater surface area than the Model 44-10. In order to assess historical trends, the Model 44-20 results were normalized for comparison.

Each monitor point was logged at one-foot intervals beginning at the top of the borehole to the bottom. Measurements were collected for one minute at each depth and recorded in the field log for each monitor point. The scintillator probe and the 25-foot coaxial cable were wiped clean using a damp disposable towel after each use. Figure C-1 presents photographs of RW-02 radiation monitoring.

## **C2.0        Radiological Monitoring Results**

Historical gamma radiation measurements from 2000 through 2011 are presented in Tables C-1 through C-6 for results from the surface background, BG-1, and the four monitoring points. Figures C-2 through C-6 depict the 2011 results compared to historical maximum and minimum results. The Long-Term Monitoring Plan (ARCADIS, 2000) established the action level as twice the gamma counts detected in the background monitoring point (BG-1). The lowest reading from BG-1 was used to calculate the action level for each monitoring event. During the RW-02 monitoring, radiation measurements in the four monitoring points have not exceeded the calculated action levels.

**Table C-1**  
**Historical Surface Background Gamma Radiation Measurements**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Date of Measurement	Surface Background Gamma Radiation Measurements (cpm)			
	Pre-Monitoring Measurements		Post-Monitoring Measurements	
	Reading	Normalized Value	Reading	Normalized Value
5/12/2011	8,431	NA	8,800	NA
5/12/2010	6,542	NA	6,523	NA
5/21/2009	9,315	NA	9,318	NA
7/2/2008	24,538	8,179	23,943	7,981
8/21/2006	26,408	8,803	25,485	8,495
7/21/2005	8,957	NA	8,977	NA
7/12/2004	8,923	NA	8,959	NA
8/26/2003	8,296	NA	7,983	NA
9/10/2002	7,921	NA	7,486	NA
8/8/2001	9,484	NA	9,431	NA
5/23/2000	9,236	NA	9,366	NA

Notes:

The readings collected in 2006 and 2008 were collected utilizing a 44-20 scintillator probe. The other readings were obtained with a 44-10 scintillator probe. The model 44-20 scintillator probe has a greater surface area than the 44-10 probe, by a factor of three. The model 44-20 results were normalized in order for comparison with the model 44-10 results.

cpm = counts per minute

NA = not applicable

**Table C-2**  
**Historical Gamma Radiation Measurements for BG-1**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Depth (ft bgs)	Gamma Radiation Measurements (cpm)												
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006		7/2/2008		5/21/2009	5/12/2010	5/12/2011
	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Normalized Value	Reading	Normalized Value	Reading	Reading	Reading
1	16,354	16,304	13,920	14,470	16,215	15,148	43,327	14,442	35,822	11,941	18,082	10,840	17,705
2	19,959	19,618	16,292	17,129	19,149	18,520	48,808	16,269	43,891	14,630	19,489	12,282	20,027
3	14,453	14,795	12,780	14,082	14,849	14,486	36,339	12,113	44,486	14,829	15,106	9,507	15,592
4	14,057	13,749	12,105	12,565	13,968	13,375	36,257	12,086	34,706	11,569	14,598	9,050	14,095
5	14,844	14,056	12,488	13,001	14,268	13,625	34,703	11,568	34,411	11,470	14,448	9,259	13,851
6	13,444	13,030	11,771	12,664	13,377	13,105	33,713	11,238	34,386	11,462	13,643	8,927	13,612
7	13,393	13,219	11,458	12,273	13,223	12,793	33,672	11,224	33,120	11,040	13,019	8,305	14,180
8	12,859	12,492	10,759	11,552	12,473	12,186	33,321	11,107	31,972	10,657	12,801	9,171	13,345
9	12,980	13,085	11,334	11,924	13,035	12,436	32,921	10,974	31,405	10,468	13,529	9,222	13,832
10	12,549	12,070	10,656	11,141	12,208	11,864	31,727	10,576	32,347	10,782	12,891	9,062	12,436
11	12,762	12,177	10,714	11,398	12,319	12,049	31,558	10,519	30,082	10,027	12,905	8,444	12,858
12	11,647	11,558	10,298	10,825	11,474	11,131	30,982	10,327	30,455	10,152	12,536	7,957	11,682
13	12,920	12,115	11,340	11,493	12,759	12,170	32,889	10,963	29,016	9,672	13,643	9,170	13,361
14	13,915	13,049	11,871	12,605	13,242	12,610	32,674	10,891	32,296	10,765	13,910	8,886	14,412
15	13,807	12,920	11,628	12,408	13,765	12,823	34,014	11,338	33,264	11,088	14,393	9,345	13,911
16	14,343	13,536	12,425	12,895	14,141	13,585	34,777	11,592	33,895	11,298	14,927	10,758	14,946
17	15,300	14,823	13,297	13,825	15,328	14,533	37,543	12,514	36,469	12,156	15,515	10,844	16,219
18	15,495	14,459	13,350	14,359	14,873	14,366	38,130	12,710	38,147	12,716	15,896	11,545	14,703
19	16,041	15,613	13,953	14,833	15,557	14,654	39,299	13,100	38,498	12,833	16,358	na	na

Notes:

The readings collected in 2006 and 2008 were collected utilizing a 44-20 scintillator probe. The other readings were obtained with a 44-10 scintillator probe. The model 44-20 scintillator probe has a greater surface area than the 44-10 probe, by a factor of three. The model 44-20 results were normalized in order for comparison with the model 44-10 results.

cpm = counts per minute

ft bgs = feet below ground surface

na = Not available



**Table C-3**  
**Historical Gamma Radiation Measurements for MP-1**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Depth (ft bgs)	Gamma Radiation Measurements (cpm)												
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006		7/2/2008		5/21/2009	5/12/2010	5/12/2011
	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Normalized Value	Reading	Normalized Value	Reading	Reading	Reading
1	16,279	16,673	14,021	14,989	16,541	15,476	41,379	13,793	39,182	13,061	18,456	12,176	18,701
2	18,972	18,994	12,724	16,484	18,346	17,951	48,560	16,187	43,243	14,414	19,309	12,112	19,743
3	14,705	14,287	9,367	13,792	14,632	13,242	36,887	12,296	43,162	14,387	12,938	8,448	14,602
4	11,559	11,612	10,765	10,240	11,104	11,539	28,247	9,416	31,220	10,407	12,804	7,151	12,408
5	12,978	13,231	9,588	11,100	12,622	10,624	32,449	10,816	27,660	9,220	13,345	8,285	13,540
6	11,558	11,377	8,589	10,905	10,867	12,470	27,813	9,271	31,959	10,653	12,249	7,390	12,020
7	10,546	10,310	8,480	9,197	9,742	9,537	25,971	8,657	26,484	8,828	11,118	6,948	11,145
8	10,764	10,565	10,463	9,124	10,044	9,913	25,869	8,623	25,134	8,378	11,544	7,271	12,437
9	13,208	13,113	10,086	10,631	12,654	11,998	32,252	10,751	26,274	8,758	13,839	9,075	13,299
10	12,532	11,917	9,482	11,213	11,325	11,051	31,152	10,384	32,204	10,735	12,397	7,209	12,593
11	11,819	11,623	8,977	10,364	10,872	10,467	27,146	9,049	28,795	9,598	12,220	7,039	12,272
12	11,322	11,334	9,763	10,107	10,552	10,024	27,384	9,128	27,273	9,091	12,236	7,686	13,683
13	11,867	11,863	9,545	10,430	11,081	10,989	29,399	9,800	28,100	9,367	12,891	9,141	13,879
14	13,687	14,054	10,936	12,066	12,694	12,270	33,478	11,159	29,729	9,910	14,368	9,626	15,630
15	13,042	13,370	11,408	12,204	12,104	11,771	32,228	10,743	34,259	11,420	13,244	7,636	13,607
16	12,659	12,775	10,265	11,188	12,221	11,334	31,420	10,473	29,524	9,841	13,684	9,978	15,512
17	15,471	15,589	13,110	13,843	14,911	14,041	37,532	12,511	34,985	11,662	15,407	8,862	14,374
18	14,230	14,038	11,567	12,508	12,993	12,529	34,690	11,563	36,735	12,245	14,780	9,509	15,053
19	14,024	14,954	11,208	12,199	12,987	12,560	35,020	11,673	33,354	11,118	14,662	na	na

Notes:

The readings collected in 2006 and 2008 were collected utilizing a 44-20 scintillator probe. The other readings were obtained with a 44-10 scintillator probe.

The model 44-20 scintillator probe has a greater surface area than the 44-10 probe, by a factor of three. The model 44-20 results were normalized in order for comparison with the model 44-10 results.

cpm = counts per minute

ft bgs = feet below ground surface

na = not applicable

**Table C-4**  
**Historical Gamma Radiation Measurements for MP-2**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Depth (ft bgs)	Gamma Radiation Measurements (cpm)												
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006		7/2/2008		5/21/2009	5/12/2010	5/12/2011
	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Normalized Value	Reading	Normalized Value	Reading	Reading	Reading
1	16,160	16,366	13,609	15,214	16,171	15,360	41,729	13,910	39,259	13,086	16,600	10,587	16,683
2	19,238	19,923	15,708	16,706	19,080	18,362	50,390	16,797	46,215	15,405	19,465	11,417	21,902
3	16,069	16,008	12,620	15,059	16,485	15,227	40,845	13,615	42,625	14,208	14,754	9,076	14,750
4	12,227	12,368	10,090	11,880	12,443	11,477	30,450	10,150	33,476	11,159	11,933	7,828	11,994
5	11,747	11,637	9,355	9,923	11,363	10,655	28,500	9,500	28,472	9,491	11,733	6,897	11,509
6	11,027	11,158	8,904	9,530	10,514	10,096	26,557	8,852	27,489	9,163	11,340	6,483	11,955
7	11,132	10,982	9,127	9,356	10,251	9,761	26,271	8,757	26,009	8,670	11,122	6,844	11,189
8	11,703	11,526	9,485	9,194	10,908	10,680	28,018	9,339	28,497	9,499	11,216	7,109	11,416
9	11,245	11,077	9,269	9,955	10,259	9,981	27,418	9,139	26,560	8,853	10,887	7,218	11,618
10	12,434	12,613	10,801	11,537	11,771	11,528	31,433	10,478	28,161	9,387	13,350	8,454	13,623
11	13,720	13,404	11,485	11,629	12,851	12,246	33,314	11,105	32,434	10,811	13,636	7,469	12,683
12	13,368	13,100	11,246	11,706	12,764	12,460	32,411	10,804	32,761	10,920	13,582	8,485	13,093
13	13,539	13,401	11,327	11,552	13,119	12,246	34,305	11,435	32,791	10,930	13,602	8,922	13,243
14	14,152	14,095	12,024	12,237	13,153	12,768	35,236	11,745	34,347	11,449	13,128	8,328	13,788
15	12,956	13,222	10,854	11,368	12,261	11,535	31,889	10,630	32,510	10,837	12,360	8,482	13,018
16	12,100	12,404	10,205	10,509	11,634	11,082	30,376	10,125	30,476	10,159	12,154	8,418	11,824
17	12,896	12,487	11,045	10,381	12,043	11,309	31,581	10,527	30,494	10,165	12,288	9,037	13,399
18	15,835	16,242	13,982	13,915	14,963	14,731	39,680	13,227	34,999	11,666	15,907	10,272	17,489
19	16,023	16,125	13,845	13,951	15,107	14,361	38,878	12,959	39,284	13,095	15,888	10,111	16,126
20	16,541	16,566	13,450	14,307	15,680	14,297	38,391	12,797	39,747	13,249	16,028	10,419	na

Notes:

The readings collected in 2006 and 2008 were collected utilizing a 44-20 scintillator probe. The other readings were obtained with a 44-10 scintillator probe.

The model 44-20 scintillator probe has a greater surface area than the 44-10 probe, by a factor of three. The model 44-20 results were normalized in order for comparison with the model 44-10 results.

cpm = counts per minute

ft bgs = feet below ground surface

**Table C-5**  
**Historical Gamma Radiation Measurements for MP-3**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Depth (ft bgs)	Gamma Radiation Measurements (cpm)												
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006		7/2/2008		5/21/2009	5/12/2010	5/12/2011
	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Normalized Value	Reading	Normalized Value	Reading	Reading	Reading
1	18,801	18,390	15,181	16,312	17,292	17,163	49,751	16,584	43,386	14,462	19,324	12,299	20,626
2	20,965	20,434	16,886	17,270	20,221	19,357	53,302	17,767	48,176	16,059	20,929	12,894	20,636
3	19,100	19,016	15,428	16,598	18,436	17,643	48,204	16,068	48,715	16,238	17,966	11,009	17,889
4	13,134	14,530	11,832	12,969	14,029	13,388	35,240	11,747	41,564	13,855	13,595	9,229	14,356
5	13,174	13,270	11,129	11,710	13,175	12,376	31,740	10,580	34,292	11,431	13,300	8,142	14,343
6	13,155	13,181	11,249	11,838	12,862	12,318	32,340	10,780	33,089	11,030	13,150	8,717	13,729
7	13,140	13,168	10,982	11,422	12,662	12,348	32,284	10,761	33,100	11,033	12,558	8,157	13,027
8	12,892	12,413	10,659	10,816	11,837	11,475	30,635	10,212	32,079	10,693	12,875	7,985	13,004
9	12,841	12,962	11,046	11,198	12,682	12,193	33,060	11,020	31,104	10,368	13,250	8,364	13,316
10	14,010	14,086	12,006	12,110	13,490	13,318	34,871	11,624	33,557	11,186	14,576	8,962	14,049
11	13,808	13,516	11,643	11,706	13,597	12,402	33,845	11,282	34,020	11,340	13,955	9,520	14,931
12	14,060	13,961	11,829	11,927	12,954	13,258	33,487	11,162	34,293	11,431	14,520	9,039	14,643
13	14,798	14,554	12,616	12,175	13,294	15,209	37,363	12,454	34,887	11,629	15,202	9,570	15,178
14	16,657	16,851	14,375	14,466	14,214	14,598	40,607	13,536	39,308	13,103	16,533	9,845	17,366
15	15,494	15,811	13,459	13,711	15,780	14,120	37,770	12,590	39,954	13,318	15,975	9,979	14,815
16	14,897	15,048	12,793	12,948	14,343	14,517	36,241	12,080	37,993	12,664	15,388	10,038	15,036
17	15,248	15,396	13,136	13,231	14,660	15,704	39,495	13,165	37,517	12,506	16,221	11,185	17,244
18	16,864	16,637	14,377	14,595	15,875	15,693	41,200	13,733	40,636	13,545	17,776	10,378	17,451
19	16,470	16,518	14,507	14,552	15,768	15,371	37,705	12,568	41,155	13,718	16,846	10,579	15,977
20	15,599	15,453	13,015	13,507	14,510	12,707	37,828	12,609	38,054	12,685	15,398	9,593	na

Notes:

The readings collected in 2006 and 2008 were collected utilizing a 44-20 scintillator probe. The other readings were obtained with a 44-10 scintillator probe.

The model 44-20 scintillator probe has a greater surface area than the 44-10 probe, by a factor of three. The model 44-20 results were normalized in order for comparison with the model 44-10 results.

cpm = counts per minute

ft bgs = feet below ground surface

**Table C-6**  
**Historical Gamma Radiation Measurements for MP-4**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Depth (ft bgs)	Gamma Radiation Measurements (cpm)												
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006		7/2/2008		5/21/2009	5/12/2010	5/12/2011
	Reading	Reading	Reading	Reading	Reading	Reading	Reading	Normalized Value	Reading	Normalized Value	Reading	Reading	Reading
1	19,932	19,656	16,734	17,570	19,783	18,209	47,277	15,759	44,181	14,727	20,982	12,508	21,472
2	19,891	20,021	16,464	13,169	18,958	18,395	51,568	17,189	51,900	17,300	19,946	12,705	20,013
3	14,725	14,602	12,621	12,628	14,327	13,193	38,352	12,784	40,178	13,393	14,601	9,330	14,996
4	14,303	14,289	11,757	12,106	13,706	13,182	34,161	11,387	36,346	12,115	14,188	9,143	13,677
5	13,985	13,957	11,310	11,967	13,263	12,822	32,409	10,803	35,316	11,772	13,466	8,325	13,442
6	13,836	14,016	11,519	12,007	13,139	12,594	33,563	11,188	33,927	11,309	13,598	9,123	14,477
7	15,839	13,776	11,534	11,718	13,253	12,310	33,235	11,078	34,743	11,581	13,613	9,030	13,310
8	13,662	13,682	11,813	12,271	13,207	12,166	32,430	10,810	33,739	11,246	13,106	8,322	14,022
9	13,856	14,095	11,926	11,687	13,376	12,662	33,299	11,100	33,772	11,257	14,080	9,001	14,063
10	13,697	13,558	11,531	11,334	12,973	12,169	32,036	10,679	34,246	11,415	12,499	8,045	13,149
11	13,144	13,252	11,314	11,767	12,431	11,623	31,878	10,626	32,304	10,768	12,831	8,178	13,284
12	13,878	13,729	11,870	12,781	13,051	12,405	31,448	10,483	32,026	10,675	13,319	9,277	13,290
13	14,967	14,960	12,830	13,088	14,080	13,367	35,142	11,714	35,197	11,732	14,775	10,028	15,845
14	15,077	15,399	12,814	13,125	14,535	13,554	36,897	12,299	37,370	12,457	14,887	9,454	15,630
15	15,606	15,389	13,016	13,072	14,506	13,711	37,779	12,593	37,754	12,585	15,015	9,753	14,359
16	15,803	15,313	13,076	13,314	14,485	13,683	37,143	12,381	38,133	12,711	15,062	9,674	14,659
17	15,183	15,450	13,128	13,207	14,741	14,062	38,015	12,672	38,157	12,719	15,654	9,784	15,486
18	16,035	16,258	14,279	14,328	15,443	14,725	38,767	12,922	39,479	13,160	16,322	10,078	16,024
19	15,031	14,947	12,632	13,363	14,231	13,511	36,375	12,125	38,517	12,839	14,993	na	na

Notes:

The readings collected in 2006 and 2008 were collected utilizing a 44-20 scintillator probe. The other readings were obtained with a 44-10 scintillator probe. The model 44-20 scintillator probe has a greater surface area than the 44-10 probe, by a factor of three. The model 44-20 results were normalized in order for comparison with the model 44-10 results.

cpm = counts per minute

ft bgs = feet below ground surface

na = Not applicable



Photograph 1: Fencing and placard around radioactive burial site.



Photograph 2: The Ludlum Model 2221 portable scaler/ratemeter and Model 44-10 scintillator probe next to monitoring point MP-4.



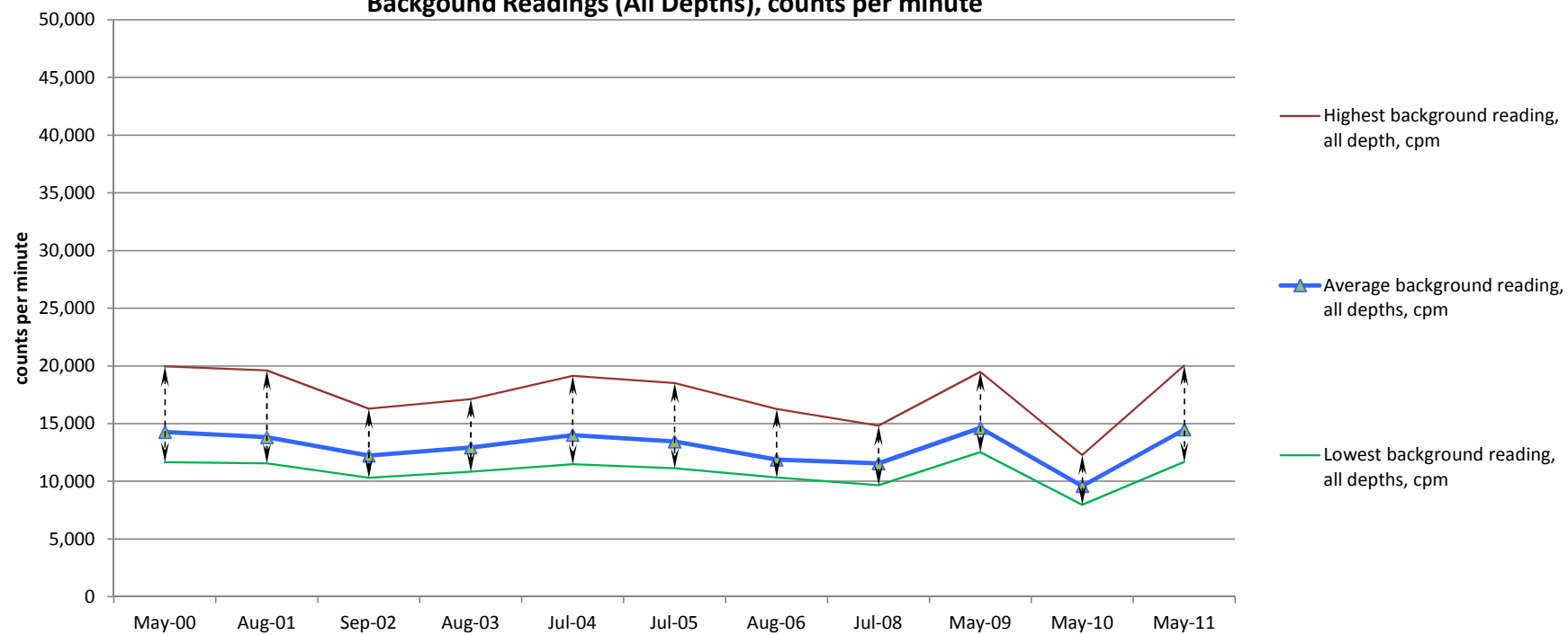
# Gamma Radiation Monitoring Third Five-Year Review Report

Luke Air Force Base

July 2012

Figure C-1

**Figure C-2**  
**Background Readings (All Depths), counts per minute**



**Figure C-3**  
**MP-1: Ratio of Gamma Readings to Background at Corresponding Depth**

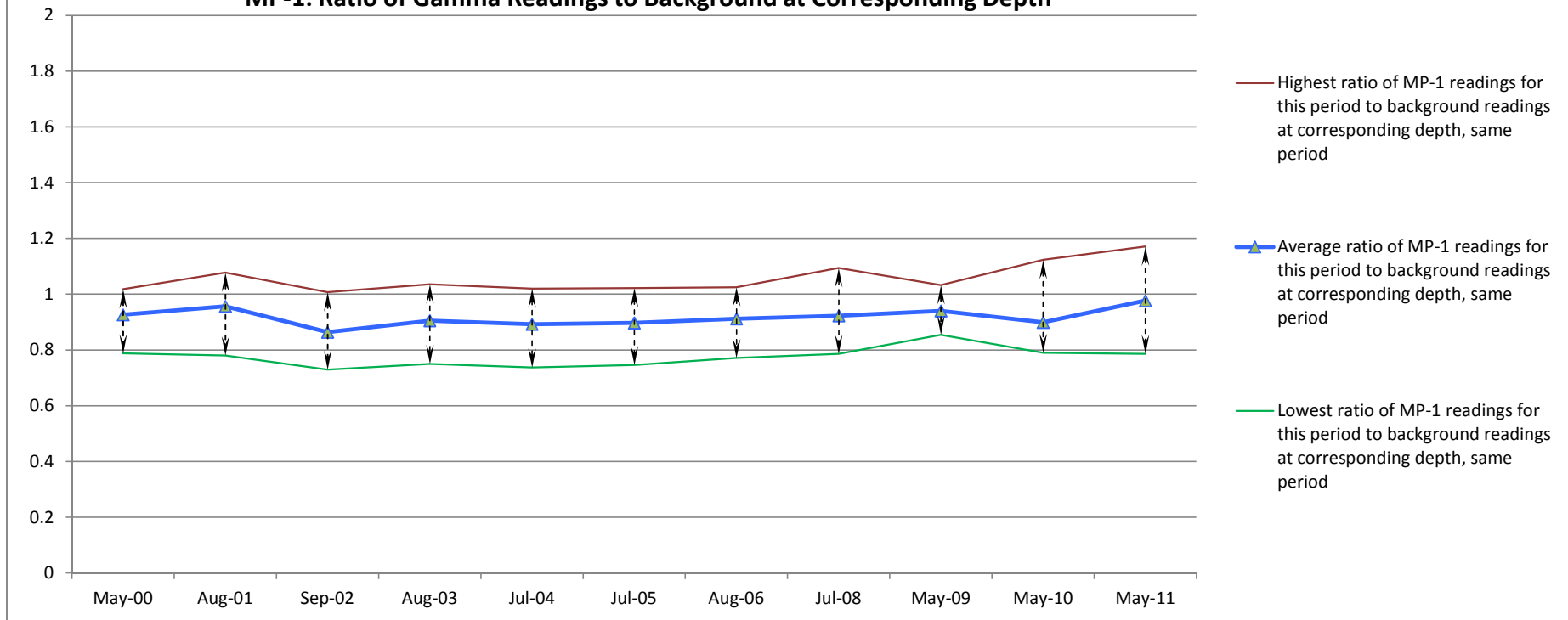


Figure C-4

MP-2: Ratio of Gamma Readings to Background at Corresponding Depth

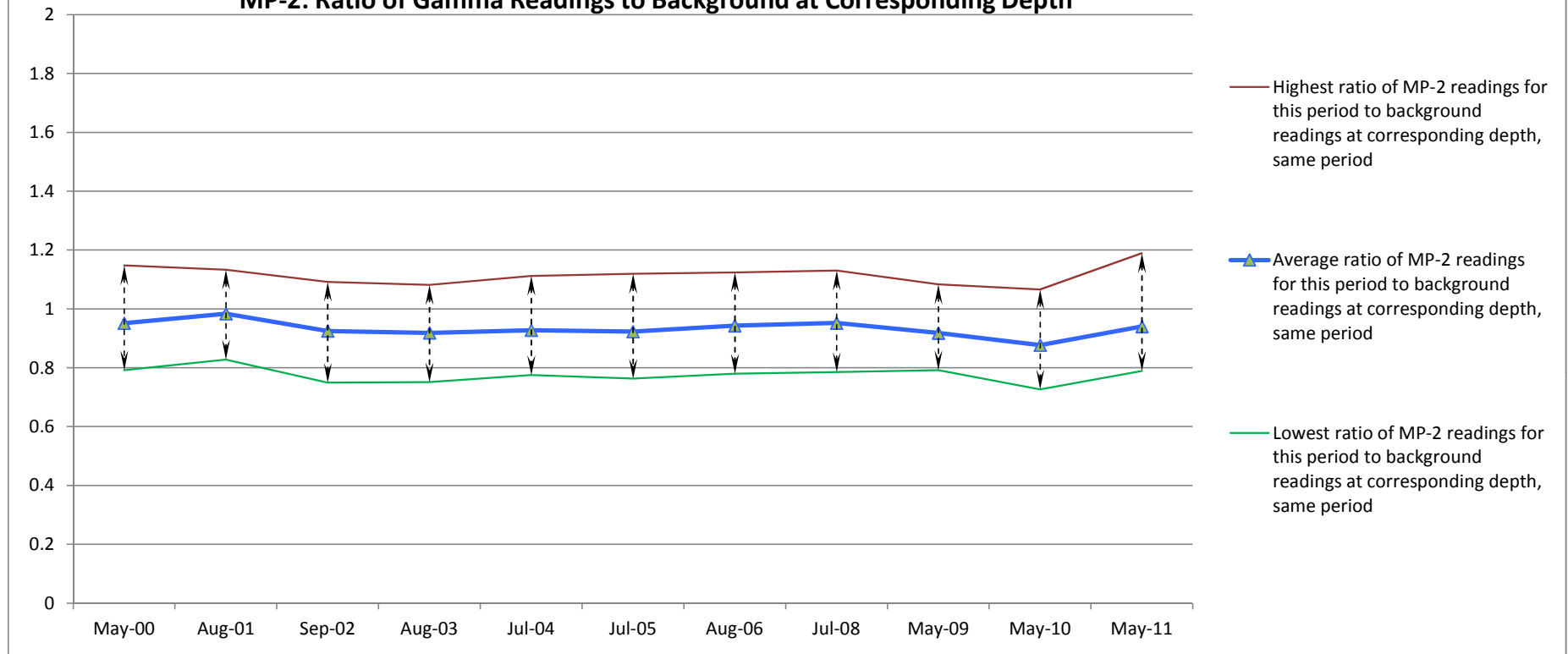




Figure C-5

MP-3: Ratio of Gamma Readings to Background at Corresponding Depth

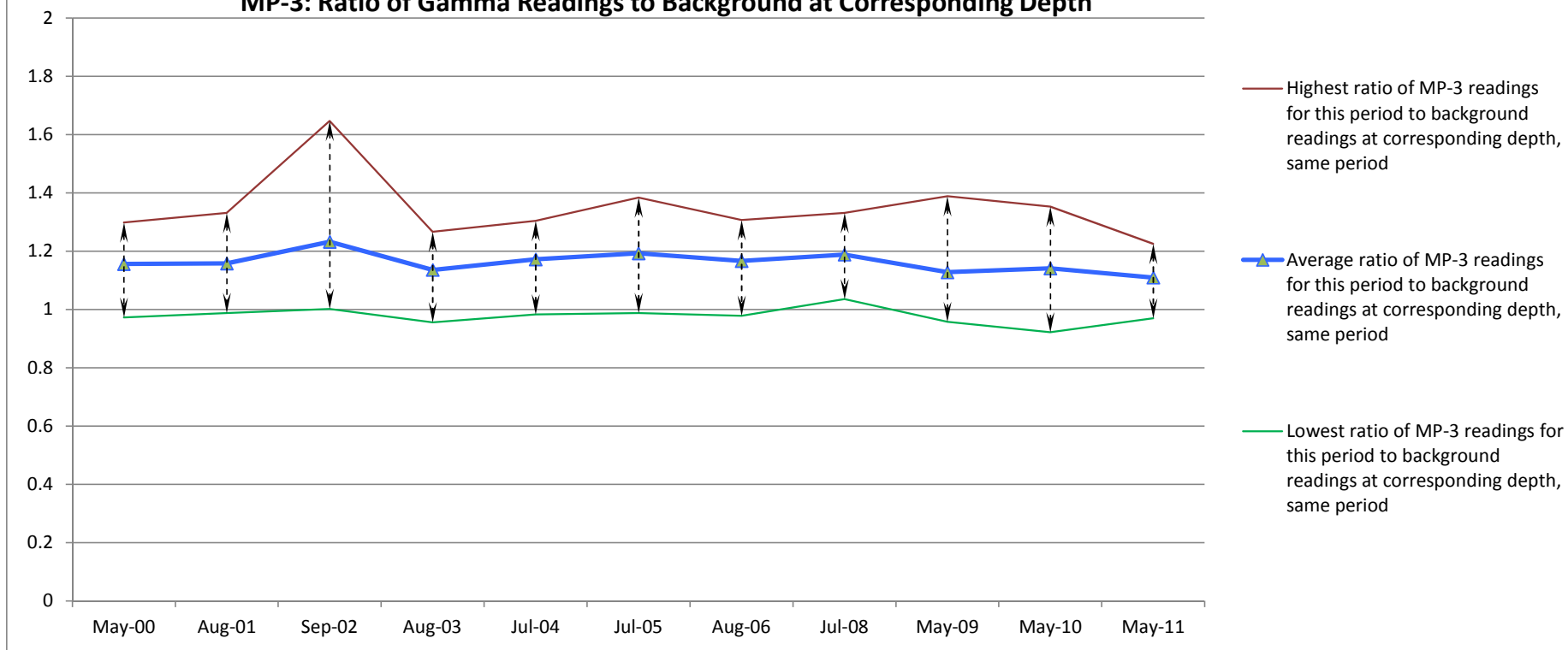
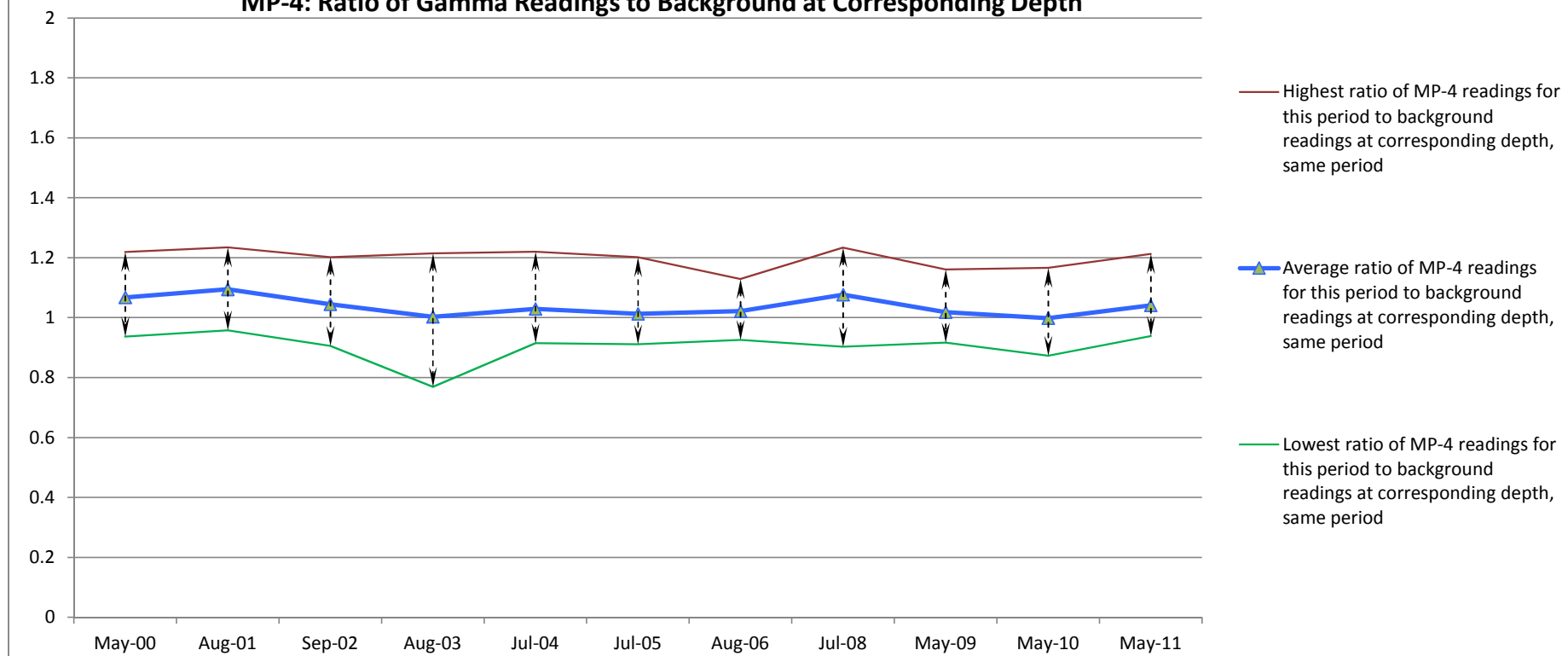


Figure C-6

MP-4: Ratio of Gamma Readings to Background at Corresponding Depth



## **Appendix D**

### **Summary of Long-Term Groundwater Monitoring**

## D1.0 Introduction

Long-term groundwater monitoring is performed to document the effectiveness of remedies implemented in accordance with the OU-1 and OU-2 RODs. Annual monitoring is performed at ST-18 and SS-42. Monitoring wells at sites FT-07, SD-20, and RW-02 are sampled every five years in conjunction with the five-year review report. Table D-1 summarizes the sampling schedule since the Second Five-Year Review Report.

<b>Table D-1</b> <b>Sampling Schedule for Long-term Groundwater Monitoring</b>				
<b>PCS</b>	<b>Well IDs</b>	<b>May 19 &amp; 26, 2009</b>	<b>May 10 - 11, 2010</b>	<b>May 9 -12, 2011</b>
<b>OU-1</b>				
FT-07E	MW-118-S	--	--	●
	MW-123-S	--	--	●
SD-20	MW-113-S	--	--	●
	MW-112S-S	--	--	●
	MW-112D	--	--	●
RW-02	MW-124-S	--	--	●
SS-42	MW-121-S	●	●	●
	MW-125R-S	●	●	●
<b>OU-2</b>				
ST-18	MW-114-S	●	●	●
	MW-122-S	●	●	●

To evaluate the potential human health and environmental threat posed by each site, contaminant concentrations were compared to the ADEQ Aquifer Water Quality Standards (AWQS) and the USEPA Maximum Contaminant Levels (MCLs).

The following is a summary of the long-term groundwater monitoring activities and results. Additional monitoring details, as well as the purge logs, data validation summaries, and certified analytical laboratory reports, are included in the annual long-term groundwater reports prepared for each of the monitoring events.

## D2.0 Monitoring Activities

Depth-to-water measurements were collected from the monitoring wells, prior to purging activities, using an electronic water level indicator. Water level measurements were taken from either the notch located at the top-of-well casing, or if the casing was not marked, from the north edge of the top-of-well casing. Equipment used for groundwater level measurements was

decontaminated prior to each well measurement. During the course of collecting water level measurements, observations of well condition were noted and recorded.

Monitoring wells were purged using the low-flow sampling methodology. Due to the rising groundwater elevation at the site, the majority of the monitoring wells are associated with newer wells, located near the original wells, which were installed with a shallower screen interval. The wells sampled were selected based on the water level measurements. The wells with depth-to-water measurements within the screened interval were purged and sampled. Table D-2 presents the screen intervals of the long-term monitoring wells.

<b>Table D-2</b>		
<b>Groundwater Monitoring Well Screen Intervals</b>		
<b>PSC</b>	<b>Well ID</b>	<b>Screen Interval (ft bgs)</b>
ST-18	MW-114	305-385
	MW-114-S	215-315
	MW-122	266-366
	MW-122-S	191-291
SS-42	MW-121	267-367
	MW-121-S	176-276
	MW-125R	260-360
	MW-125R-S	175-275
SD-20	MW-112S	280-340
	MW-122S-S	190-290
	MW-122D	380-430
	MW-113	320-400
	MW-113-S	210-310
FT-07E	MW-118	293-393
	MW-118-S	205-305
	MW-123	295-380
	MW-123-S	195-295
RW-02	MW-124	165-300
	MW-124-S	180-280

Notes: ft bgs = feet below ground surface

Water quality parameters including temperature, pH, specific conductance, dissolved oxygen (DO), turbidity, and oxidation reduction potential (ORP) were monitored during purging to determine when the flow and quality of the water had stabilized. A multiparameter probe, equipped with an in-line flow-through cell connected to the pump discharge, and a turbidity meter were used to record water quality parameters. The instruments were calibrated prior to the start of the groundwater monitoring event. During the 2011 calibration of the multiparameter probe, it was noted that DO was not calibrating properly. The 2011 DO reading may be biased due to calibration problems.

These samples were transported to TestAmerica Laboratories, an Arizona-certified laboratory, under chain-of-custody, and analyzed for the following analytical parameters:

- Volatile Organic Compounds (VOCs) using USEPA Method 8260B
- Total Petroleum Hydrocarbons (TPH) diesel and gasoline ranges using USEPA Modified Method 8015D

### **D3.0 Monitoring Results**

Attachment D-1 presents the depth-to-water measurements and the groundwater elevations since the Second Five-Year Review Report. Since 2008, groundwater elevations increases have ranged from 8.36 feet (MW-122S-S) to 21.83 feet (MW-124-S).

Groundwater results from 2008 through 2011 are summarized in Attachment D-2. During this time period, results were not detected above the applicable AWQS levels. Detections are summarized below:

- ST-18: TPH-Diesel was detected at MW-114-S (0.51 mg/L) during the July 2008 monitoring event. All other results were not detected about the reporting limits.
- SS-42: 1,2-Dichloropropane was detected in MW-121-S and MW-125R-S during the 2009 through 2011 monitoring events, ranging from 0.52 to 1.4 ug/L. Historically, 1,2-dichloropropane was used as a soil fumigant on a variety of crops, including citrus. Citrus orchards were previously located upgradient of the site.
- SD-20: Trichloroethene was detected in MW-113-S and MW-122S-S, ranging from 0.65 to 1.5 ug/L, and MW-113-S had a one-time detection of 1,2-dichloroethane (0.67 ug/L) in the 2011 monitoring event. The deeper well, MW-112D, did not have any detections above the reporting limits.
- FT-07E and RW-02: Monitoring wells at these sites did not have any detections above reporting limits.

### **D4.0 Conclusions**

Groundwater samples were collected at site ST-18 and SS-42 as part of the annual long-term monitoring program. Samples from sites FT-07, SD-20, and RW-02 were collected under the five-year CERCLA review. Groundwater elevations at on-site wells continue to increase at a rate of approximately 5 feet per year. The groundwater results at sites ST-18, SS-42, SD-20, FT-07, and RW-02 were below their respective USEPA MCLs and AQWSs.



The results of the 2011 annual groundwater monitoring event conducted at sites ST-18 and SS-42 at Luke AFB were consistent with previous annual monitoring data. In accordance with the sampling frequency as specified in the OU-1 and OU-2 RODs, the next annual monitoring event for sites ST-18 and SS-42 will be conducted in May 2012.

Results for sites SD-20, FT-07, and RW-02 are consistent with past monitoring performed under the five-year CERLA review program. These monitoring wells will be sampled again in 2016.

**Attachment D-1**  
**Historical Groundwater Elevation Summary**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Site	Well Number	Gauging Date	Well Elevation (ft amsl)	Depth to Static Water (feet)	Groundwater Elevation (ft amsl)	Historical Delta (feet)
ST-18	MW-114	05/09/11	1071.59	242.11	829.48	15.49
		05/10/10	1071.59	245.35	826.24	
		05/18/09	1071.59	253.50	818.09	
		07/14/08	1071.59	257.60	813.99	
	MW-114-S	05/09/11	1072.16	242.26	829.90	17.25
		05/10/10	1072.16	247.18	824.98	
		05/18/09	1072.16	252.83	819.33	
		07/14/08	1071.13	258.48	812.65	
	MW-122	05/09/11	1070.82	242.40	828.42	15.53
		05/10/10	1070.82	246.96	823.86	
		05/18/09	1070.82	252.76	818.06	
		07/14/08	1070.82	257.93	812.89	
	MW-122-S	05/09/11	1070.80	241.73	829.07	16.30
		05/10/10	1070.80	247.13	823.67	
		05/18/09	1070.80	252.15	818.65	
		07/14/08	1070.80	258.03	812.77	
SS-42	MW-121	05/10/11	1084.21	240.81	843.40	14.98
		05/11/10	1084.21	245.88	838.33	
		05/18/09	1084.21	250.62	833.59	
		07/15/08	1084.21	255.79	828.42	
	MW-121-S	05/10/11	1083.18	240.39	842.79	14.55
		05/11/10	1083.18	245.45	837.73	
		05/18/09	1083.18	250.15	833.03	
		07/15/08	1083.18	254.94	828.24	
	MW-125R	05/10/11	1081.00	236.91	844.09	14.94
		05/11/10	1081.00	241.97	839.03	
		05/18/09	1081.00	246.73	834.27	
		07/14/08	1081.00	251.85	829.15	
	MW-125R-S	05/10/11	1080.01	237.33	842.68	14.51
		05/11/10	1080.01	242.40	837.61	
		05/18/09	1080.01	247.14	832.87	
		07/14/08	1080.01	251.84	828.17	
SD-20	MW-113-S	05/10/11	1063.72	271.91	791.81	12.71
		07/16/08	1063.72	284.62	779.10	
	MW-112S-S	05/12/11	1062.82	258.77	804.05	8.36
		07/16/08	1062.82	267.13	795.69	
	MW-112D	05/12/11	1061.72	257.19	804.53	10.74
		07/16/08	1061.44	267.65	793.79	

**Attachment D-1**  
**Historical Groundwater Elevation Summary**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Site	Well Number	Gauging Date	Well Elevation (ft amsl)	Depth to Static Water (feet)	Groundwater Elevation (ft amsl)	Historical Delta (feet)
FT-07E	MW-118-S	05/11/11	1091.70	253.94	837.76	15.13
		07/15/08	1091.70	269.07	822.63	
	MW-123-S	05/11/11	1092.06	255.80	836.26	15.28
		07/15/08	1092.06	271.08	820.98	
RW-02	MW-124-S	05/11/11	1072.16	234.71	837.45	21.83
		07/11/08	1072.16	256.54	815.62	

Notes:

ft amsl = feet above mean sea level

Historical groundwater elevations are presented since the Second Five-Year Review Report (2007)

Historical Delta = Difference between 2008 groundwater elevation and most recent elevation

Monitoring point elevations updated based on file supplied from Luke AFB personnel

(LukeAFBmonitorwellpoints.xls, last modified 5/2/2011) and the Annual Groundwater Long-Term Monitoring Report (Terra Dynamic, 2009)

**Attachment D-2**  
**Historical Groundwater Results Summary**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Site	Well ID	Date Collected	Volatile Organics (ug/L)							TPH (mg/L)		
			Benzene	Toluene	Ethylbenzene	Xylenes	1,2-DCA	1,2-DCP	TCE	Diesel Range	Gasoline Range	
AWQS			5.0	1,000	700	10,000	5.0	5.0	5.0	NA	NA	
ST-18	MW-114-S	5/9/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20	
		5/10/2010	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50	<0.50	<0.10	<0.20	
		5/19/2009	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50	<0.50	<0.10	<0.20	
		7/14/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	0.51	<0.10	
	MW-122-S	5/9/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20	
		5/10/2010	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50	<0.50	<0.10	<0.20	
		5/26/2009	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50	<0.50	<0.10	<0.20	
		7/14/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10	
SS-42	MW-125R-S	5/10/2011	<0.50	<0.50	<0.50	<1.5	<0.50	0.88	<0.50	<0.10	<0.20	
		5/11/2010	<0.50	<0.50	<0.50	<1.0	<0.50	1.4	<0.50	<0.10	<0.20	
		5/26/2009	<0.50	<0.50	<0.50	<1.0	<0.50	0.69	<0.50	<0.10	<0.20	
		7/14/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10	
	MW-121-S	5/10/2011	<0.50	<0.50	<0.50	<1.5	<0.50	1.4	<0.50	<0.10	<0.20	
		5/11/2010	<0.50	<0.50	<0.50	<1.0	<0.50	0.52	<0.50	<0.10	<0.20	
		5/19/2009	<0.50	<0.50	<0.50	<1.0	<0.50	0.79	<0.50	<0.10	<0.20	
		7/15/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10	
SD-20	MW-113-S	5/10/2011	<0.50	<0.50	<0.50	<1.5	0.67	<0.50	0.65	<0.10	<0.20	
		7/16/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10	
	MW-112S-S	5/12/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	1.5	<0.10	<0.20
		7/16/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	1.1	<0.10	<0.10
	MW-112D	5/12/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.50	<0.10	<0.20
		7/16/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<1.0	<0.11	<0.10
FT-07E	MW-118-S	5/11/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20	
		7/15/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10	
	MW-123-S	5/11/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20	
		7/15/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10	
RW-02	MW-124-S	5/11/2011	<0.50	<0.50	<0.50	<1.5	<0.50	<0.50	<0.50	<0.10	<0.20	
		7/11/2008	<1.0	<5.0	<1.0	<3.0	<1.0	<1.0	<1.0	<0.10	<0.10	

Notes:

ug/L = micrograms per liter; mg/L = milligrams per liter; AWQS = Aquifer Water Quality Standard

1,2-DCP = 1,2-Dichloropropane; 1,2-DCA = 1,2-Dichloroethane; TCE = Trichloroethene; TPH - Total Petroleum Hydrocarbons

"<" = Analyte not detected above the listed reporting limit; Bolded values = Results detected above the reporting limit

## **Appendix E**

### **Summary of ST-18 Concrete Cap Inspections**

## **E1.0 Introduction**

The annual inspection at site ST-18 includes a detailed visual observation of the concrete cap. The inspection consists of walking several transects across the concrete cap area and noting visual cracks, joints, former penetrations, and other features of interest (such as previous repairs) that may affect the integrity of the cap.

Site ST-18 was capped with concrete in 1987 as part of the RCRA post-closure requirements for Luke AFB. The cap was installed as a means to control access to, and contaminant migration from, soils that may have been impacted by releases from the three former USTs located west of Building 993. The OU-2 ROD documents the cap as the selected remedial action and describes the requirements for inspection, maintenance, and repair of the concrete cap. According to design data provided by Luke AFB, the cap consists of a 30-millimeter high density polyethylene (HDPE) liner covered by six inches of aggregate base, and a nine-inch thick reinforced-concrete cap. Figure E-1 presents a site map of the ST-18 area.

## **E2.0 Inspection Activities**

Marla Miller, P.E., of ARCADIS, performed visual inspections of the concrete cap at ST-18 on May 18, 2009, May 10, 2010, and May 9, 2011. Utilizing previous inspection reports and the protocol presented in the Luke AFB Long Term Monitoring Workplan, the inspection consisted of orienting the available site diagrams with features observed in the field and then walking several transects of the concrete cap area. Cracks, joints, former penetrations, and other features of interest observed were photographed and recorded on field notes. Figure E-2 presents selected photographs of features observed during the inspections.

## **E3.0 Inspection Results**

The results of the inspections indicated that the concrete cap appears to be stable, without noticeable buckling or differential settlement. Significant vertical displacement was not observed during the inspections at cracks or expansion joints. There were no unusual cracking patterns to suggest heaving or settlement in the soil below the cap. Scaling of the cap surface area was not observed. A small rust stain was observed within the cap area; however, the surface did not appear to have been impacted by chemical degradation. The inspections specifically targeted visual observation of joints, cracks, and previous repairs as these locations represent the most likely potential routes of minor surface water infiltration.

During the 2008 concrete cap inspection, it was noted that several cuts through the concrete were made during the surface completion process for monitoring well MW-114-S. During January 2009, Tierra Dynamic sealed these concrete cuts using Crafcro Roadsaver Silicone SL sealant.

As of the May 2009 inspection, the repairs around monitoring well MW-114-S were intact and appear to be sufficient to prevent water infiltration.

During the 2010 cap inspection, several areas of previous repairs, made using an asphaltic-type crack sealant and a silicone-based material, appeared to be in need of additional rehabilitation due to insufficient repair material within the original crack or the presence of additional cracking and/or spalling. There were several areas observed where cracking and spalling have formed adjacent to previously repaired cracks. There were also several areas where new cracks and/or concrete spalling were observed, as well as a concrete popout of a corner joint. However, these minor cracks do not appear to be significantly compromising the cap integrity. Cracks and spalling observed during the 2010 inspection appeared to be very similar to conditions observed during the 2009 inspection.

Additional repairs to the cap were made in December 2010 using Craftco Roadsaver Silicone SL sealant. The December 2010 repair event focused on cracks noted during the earlier inspections. Several areas of new small or hairline cracks were observed during the May 2011 that warrant continued monitoring. However, these minor cracks do not appear to be compromising the cap integrity.

## **E4.0 Conclusions**

Previous repairs, reported in the 2008 Cap Inspection Report (Tierra Dynamic, 2009) as first-generation and third-generation, were completely replaced by either second- or fourth-generation crack/joint seal material. Additional repairs to the cap were performed in January 2009 and December 2010. These repairs focused on cracks noted during earlier inspections.


The annual inspections indicate that the cap had been maintained per the OU-2 ROD, was still functioning as intended, and remained an effective barrier to surface water infiltration. Several areas of new small or hairline cracks were observed during the May 2011 that warrant continued monitoring. However, these minor cracks do not appear to be compromising the cap integrity.





**Legend:**

All locations are approximate

 ST-18 Concrete Cap

**993** Building Number



ST-18 Site Map  
Third Five-Year Review Report  
Luke Air Force Base

Source: Maricopa County Assessor, 2008 Aerial Photograph  
SCALE IS APPROXIMATE

July 2012

**Figure E-1**



Photograph 1: Start of one of the transects walked during the 2009 cap inspection; standing next to Building 993 looking west across the cap.



Photograph 2: January 2009 repair of concrete cuts around well completion, repairs performed by Tierra Dynamic.



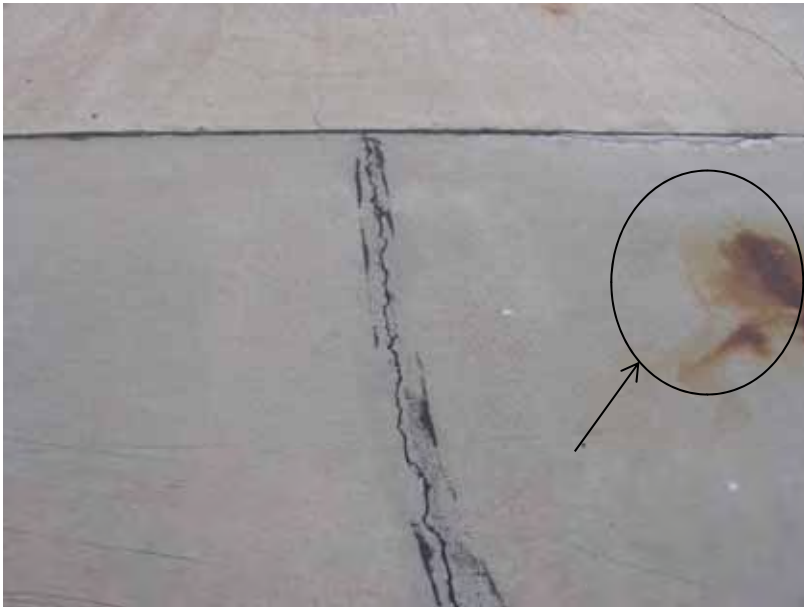
Photograph 3: Example of previous crack repair in good condition.



Inspection Photographs of  
Concrete Cap at ST-18  
Third Five-Year Review Report  
Luke Air Force Base

July 2012

Figure E-2





Photograph 4: A previous repair, thought to be 1<sup>st</sup> generation, in good condition.  
Small rust stain present of unknown origin.



Photograph 5: A previous repair that may warrant additional repairs due to additional cracking and spalling present adjacent to the repair.



Photograph 6: A previous repair that may warrant additional repairs due to additional cracking and spalling present adjacent to the repair.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>







Photograph 7: A previous repair that may warrant additional repairs due to additional cracking and lack of repair material within the repair.



Photograph 8: Example of shallow surface cracking. Cracking with vertical or horizontal displacement are considered to penetrate the full depth of the concrete thickness.



Photograph 9: A previous repair that may warrant additional repairs due to additional cracking and spalling present adjacent to the repair.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>



Photograph 10: A previous repair, that may warrant additional repairs due to additional cracking, the presence of spalling, and lack of repair material within the repair.



Photograph 11: A previous repair that may warrant additional repairs due to additional cracking and the presence of spalling. Most of the previous repairs within this area are still intact.



Photograph 12: A location in which a concrete popout has occurred at a corner joint. Repair may be warranted.



Inspection Photographs of  
Concrete Cap at ST-18  
Third Five-Year Review Report  
Luke Air Force Base

July 2012

Figure E-2





Photograph 13: For 2010 inspection, example of concrete crack that has been repaired and is in good condition.



Photograph 14: Concrete crack that may warrant additional repair work; spalling observed adjacent to the crack and some gaping of repair sealant.



Photograph 15: Hairline concrete fracture intersecting with expansion joint.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>







Photograph 16: Example of expansion joint in good condition.



Photograph 17: Example of spalling adjacent to previous crack repair.



Photograph 18: Repairs on concrete cuts around monitoring well completion; spalling observed.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>





Photograph 19: Earlier repair that may warrant additional work due to presence of spalling and missing repair material.



Photograph 20: Concrete crack, intersecting expansion joint, that is several feet long.



Photograph 21: Example of concrete crack that has been repaired multiple times.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>







Photograph 22: From 2011 inspection, example of concrete crack that has been repaired (December 2010) and is in good condition.



Photograph 23: Repair sealant in corner where spalling had been previously observed.



Photograph 24: Example of several generations of repairs.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>





Photograph 25: Hairline cracks that will continue to be monitored.



Photograph 26: Newly repaired areas marked by spray paint.



Photograph 27: Example of expansion joint that intersects monitoring well completion. Expansion joint repairs appear to be in good condition.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>





Photograph 28: Hairline crack coming off of previously repaired cracks; area will continue to be monitored.



Photograph 29: Example of repaired pop-out on expansion joint corner.



Photograph 30: Example of cracks that have been saw cut and repaired.

	
<p>Inspection Photographs of Concrete Cap at ST-18 Third Five-Year Review Report Luke Air Force Base</p>	
<p>July 2012</p>	<p>Figure E-2</p>





Photograph 31: Example of small crack at corner of concrete cap area.



Photograph 32: Example of repaired crack that had limited spalling.



Photograph 33: Crack in concrete near monitoring well that will be monitored during the next cap inspection.



Inspection Photographs of  
Concrete Cap at ST-18  
Third Five-Year Review Report  
Luke Air Force Base

July 2012

Figure E-2

## **Appendix F**

### **Affidavits for Public Notice**

# Daily News-Sun

10102 Santa Fe Drive Sun City, Arizona 85351  
623.977.8351 Fax 623.876.2589


ARCADIS U.S. INC.  
4646 E VAN BUREN STREET SUITE 400  
PHOENIX, AZ 85008

## Affidavit of Publication

I, Janet Gerster, Legal Clerk, am authorized by the publisher as agent to make this affidavit of publication. Under oath, I state that the following is true and correct.

The Daily News-Sun is a newspaper which is published daily, and is of general circulation and is in compliance with the Arizona Revised Statutes 10-140.34 & 39-201.A & B. I solemnly swear that the notice as per copy attached, was published in the regular and entire edition of the said newspaper and not in any supplement. The below listed advertisement appeared in the following issue(s):

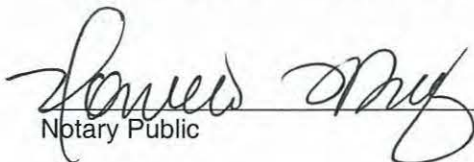
- 1) DECEMBER 19, 2011
- 2) DECEMBER 20, 2011
- 3) DECEMBER 21, 2011
- 4) DECEMBER 22, 2011
- 5) DECEMBER 23, 2011
- 6) DECEMBER 24, 2011

  
Legal Clerk

State of Arizona  
County of Maricopa

Subscribed and sworn to before me, in my presence, this 9TH day of JANUARY, 2012.



  
Notary Public

Ad caption: LUKE AFB FIVE-YEAR REVIEW PROJECT/16774403/315.77

Note: Customer is responsible for filing this document with the appropriate office.

**PUBLIC NOTICE**  
**Luke AFB EPA Five-Year Review Project**

Luke AFB was placed on the EPA's National Priorities List (NPL) in 1990 due to soil contamination resulting from past practices. After a joint effort with EPA and the Arizona Department of Environmental Quality to perform investigation and cleanup, the base was removed from the NPL in 2002. Every five years a review is conducted to ensure the investigation and cleanup continue to be protective of human health and the environment. A Five-Year Review is currently in progress and is scheduled to be completed in early 2012.

Information about the site may be viewed at <http://cfpub.epa.gov/superfund/sites/csitinfo.cfm?id=0900824>.

The contaminants of concern for the base are volatile organic compounds, semivolatile organic compounds, and metals. Environmental issues at the Base are being or have been addressed by deed restrictions, plan modifications, soil capping, and various forms of contaminant removal.

Interested parties may submit comments to Alan Thomas, Restoration Program Manager at 56 CES/CEAN; 13970 Gillespie Drive; Luke AFB, AZ 85309 or at [alan1.thomas@luke.af.mil](mailto:alan1.thomas@luke.af.mil).

Publish: Daily News-Sun  
December 19, 20, 21, 22, 23, 24, 2011/ 16774403



# AFFIDAVIT OF PUBLICATION

STATE OF ARIZONA                     )  
  ) ss.  
COUNTY OF MARICOPA             )

I, Carolyn Castillo of  
**THE GLENDALE STAR**

A newspaper of general circulation  
published and printed in the city of  
Glendale, County of Maricopa, State of  
Arizona, do solemnly swear that a copy of  
the notice, in the matter of  
PUBLIC NOTICE  
Luke AFB EPA Five-Year Review Project

As per clipping attached, was published  
weekly in the regular and entire edition  
of the said newspaper, and not in any  
supplement hereof, for a period of 1  
consecutive week(s), as follows, to-wit:  
12/22/11

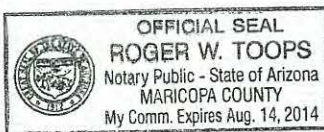
(s) Carolyn Castillo

Subscribed and sworn to before me, this  
22nd day of December (year) 2011.

(s) R. W. Toops

Notary Public

My commission expires:





liability company is  
e names of each per-

Management of the limited liability company is reserved to the members. The names of each person who is a member are:  
Rosalie Lawyer, member  
Gary Lawyer, member  
Publish The Glendale Star  
December 8, 15 and 22, 2011

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greater interest in the  
liability company are:

ARTICLES OF ORGANIZATION  
HAVE BEEN FILED IN THE OFFICE OF THE  
ARIZONA CORPORATION COMMISSION FOR

Name: CHANTLI REALTY, LLC.

The address of the registered office is:  
6943 W. Encanto Blvd.  
Phoenix, AZ 85035  
The name of the Statutory Agent is:  
Ana Ligia Coggin

Management of the limited liability company is reserved to the members. The names of each person who is a member are:  
Ana Ligia Coggin, member  
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ARTICLES OF ORGANIZATION  
HAVE BEEN FILED IN THE OFFICE OF THE  
ARIZONA CORPORATION COMMISSION FOR

Name: THE ONLINE HAIR SHOP LLC.

The address of the registered office is:  
10319 W. Camino De Oro  
Peoria, AZ 85383  
The name of the Statutory Agent is:  
Phyllis J. Hardiman

Management of the limited liability company is reserved to the members. The names of each person who is a member are:  
Phyllis J. Hardiman, member  
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Name: WILBUR AND RED, LLC.

The address of the registered office is:  
19550 N. Grayhawk Dr. #2015  
Scottsdale, AZ 85255  
The name of the Statutory Agent is:  
Krista Becka

Management of the limited liability company is vested in a manager or managers. The names of each person who is a manager AND each member who owns a twenty percent or greater interest in the capital or profits of the limited liability company are:  
Allen Brooks, manager  
Krista Becka, manager  
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greater interest in the  
liability company are:

ARTICLES OF ORGANIZATION  
HAVE BEEN FILED IN THE OFFICE OF THE  
ARIZONA CORPORATION COMMISSION FOR

Name: BLACKWELL HOMES LLC.

The address of the registered office is:  
16006 W. Lincoln St.  
Goodyear, AZ 85338  
The name of the Statutory Agent is:  
Dennis Bradford

Management of the limited liability company is reserved to the members. The names of each person who is a member are:  
Dennis Bradford, member  
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ARTICLES OF ORGANIZATION  
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Name: QUINN LAW, PLLC.

The address of the registered office is:  
40 N. Central Ave. #1400  
Phoenix, AZ 85004  
The name of the Statutory Agent is:  
Michael Ayers, Esq.

Reserved to Managers:  
Ian D. Quinn, Esq., member/manager  
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ARTICLES OF ORGANIZATION  
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ARIZONA CORPORATION COMMISSION FOR

Name: THE OLD FIREHOUSE OF JAMESPORT LLC.

The address of the registered office is:

HAVE BEEN FILED IN THE OFFICE OF THE  
ARIZONA CORPORATION COMMISSION FOR

Name: HAGA PROPERTY MANAGEMENT, LLC.

The address of the registered office is:  
10420 N. 64th Ave.  
Glendale, AZ 85302  
The name of the Statutory Agent is:  
Michael A. Haga

Management of the limited liability company is reserved to the members. The names of each person who is a member are:  
Lisa J. Haga, member  
Hillary M. Haga, member  
Marlene I. Cerreta, member  
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HAVE BEEN FILED IN THE OFFICE OF THE  
ARIZONA CORPORATION COMMISSION FOR

Name: OXYMORON ENTERPRISES LLC.

The address of the registered office is:  
2327 W. Hunter Ct.  
Phoenix, AZ 85085  
The name of the Statutory Agent is:  
Dale Andrew Phillips

Management of the limited liability company is vested in a manager or managers. The names of each person who is a manager AND each member who owns a twenty percent or greater interest in the capital or profits of the limited liability company are:  
Dale Phillips, member/manager  
Laura Burgeno, member  
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December 8, 15 and 22, 2011

ARTICLES OF ORGANIZATION  
HAVE BEEN FILED IN THE OFFICE OF THE  
ARIZONA CORPORATION COMMISSION FOR

Name: VEGA'S RV & AUTO SALES L.L.C.

The address of the registered office is:  
1248 E. Cinnabar Ave.  
Phoenix, AZ 85020  
The name of the Statutory Agent is:  
Rachel Tiffany Tan

Management of the limited liability company is reserved to the members. The names of each person who is a member are:  
Rachel Tiffany Tan, member  
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December 8, 15 and 22, 2011

ARTICLES OF ORGANIZATION  
HAVE BEEN FILED IN THE OFFICE OF THE  
ARIZONA CORPORATION COMMISSION FOR

Name: LLS ENTERPRISES, LLC.

The address of the registered office is:  
2438 W. Maya Way  
Phoenix, AZ 85085  
The name of the Statutory Agent is:  
Leandra Simmons

Person Filing: Britney Ford  
Mailing Address: 7194 W. Cielo Grande  
City, State, Zip: Peoria, AZ 85383  
Representing: Self (No Attorney)  
SUPERIOR COURT OF ARIZONA MARICOPA COUNTY  
Case No. CV2011-070540  
In the Matter of:  
ROXANNE ELLER BROWN  
NOTICE OF HEARING REGARDING APPLICATION FOR CHANGE OF NAME  
READ this NOTICE carefully. An important court proceeding that affects your rights has been scheduled. If you do not understand this notice, or the other court papers, contact an attorney for legal advice.  
1. NOTICE: An application for Change of Name has been filed with the Court by the person(s) named above. A hearing has been scheduled where the Court will consider whether to grant or deny the requested change. If you wish to be heard on this issue, you must appear at the hearing at the date and time indicated below.  
2. COURT HEARING: A court hearing has been scheduled to consider the Application as follows:  
Date: January 13, 2012  
Time: 9:00 A.M.  
BEFORE:  
Commissioner Jackie Ireland  
14264 W. Tierra Buena Lane  
Courtroom 123  
Surprise, AZ 85374  
Dated: November 30, 2011  
(s) Britney Ford  
Publish The Glendale Star  
December 8, 15, 22 and 29, 2011

## PUBLIC NOTICE

### PUBLIC NOTICE

Luke AFB EPA Five-Year Review Project  
Luke AFB was placed on the EPA's National Priorities List (NPL) in 1990 due to soil contamination resulting from past practices. After a joint effort with EPA and the Arizona Department of Environmental Quality to perform investigation and cleanup, the base was removed from the NPL in 2002. Every five years a review is conducted to ensure the investigation and cleanup continue to be protective of human health and the environment. A Five-Year Review is currently in progress and is scheduled to be completed in early 2012. Information about the site may be viewed at <http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0900884>. The contaminants of concern for the base are volatile organic compounds, semivolatile organic compounds, and metals. Environmental issues at the Base are being or have been addressed by deed restrictions, plan modifications, soil capping, and various forms of contaminant removal.  
Interested parties may submit comments to Alan Thomas, Restoration Program Manager at 56 CES/CEAN, 13970 Gillespie Drive, Luke AFB, AZ, 85309 or at [alan1.thomas@luke.af.mil](mailto:alan1.thomas@luke.af.mil).  
Publish The Glendale Star  
December 22, 2011

## PUBLIC NOTICES IN NEWSPAPERS ...

Because good  
government  
depends on it.





# THE ARIZONA REPUBLIC

**PUBLIC NOTICE**  
**Luke AFB EP A Five-Year**  
**Review Project**

Luke AFB was placed on the EPA's National Priorities List (NPL) in 1990 due to soil contamination resulting from past practices. After a joint effort with EP A and the Arizona Department of Environmental Quality to perform investigation and cleanup, the base was removed from the NPL in 2002. Every five years a review is conducted to ensure the investigation and cleanup continue to be protective of human health and the environment. A Five-Year Review is currently in progress and is scheduled to be completed in early 2012. Information about the site may be viewed at <http://cfpub.epa.gov/superfund/cursites/csitinfo.cfm?id=0900884>. The contaminants of concern for the base are volatile organic compounds, semi volatile organic compounds, and metals. Environmental issues at the Base are being or have been addressed by deed restrictions, plan modifications, soil capping, and various forms of contaminant removal. Interested parties may submit comments to Alan Thomas, Restoration Program Manager at 56 CES/CEAN, 13970 Gillespie Drive, Luke AFB, AZ, 85309 or at [alan1.thomas@luke.af.mil](mailto:alan1.thomas@luke.af.mil).

STATE OF ARIZONA  
 COUNTY OF MARICOPA } SS.

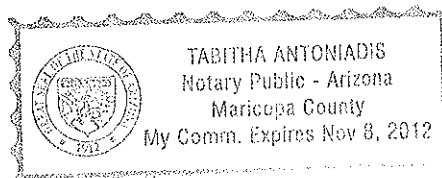
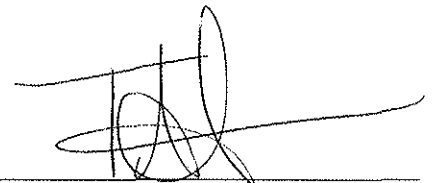
Manny Vargas, being first duly sworn, upon oath deposes and says: That he is a legal advertising representative of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic

12/27/2011



Sworn to before me this  
 22<sup>TH</sup> day of  
 February A.D. 2012

Notary Public

## **Appendix G**

### **Applicable or Relevant and Appropriate Requirements (ARARs)**

**Table G-1**  
**Summary of ARARs**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Medium	Authority	ARAR	Status	Requirement Synopsis	Action to Achieve ARAR
Groundwater	SDWA	Federal - SDWA - MCLs (40 CFR Part 141.11-141.16) and non-zero MCLGs	Relevant and Appropriate	MCLs have been adopted as enforceable standards for public drinking water systems. MCLGs are non-enforceable levels for such systems.	None
Groundwater	USEPA	Federal - SDWA - Region IX RSLs Table 2012 Update	To be considered	RSLs are generic and based on direct contact exposures which may not address site-specific conditions or indirect exposure pathways.	None
Groundwater	State	State - SDWA - Title 18, Environmental Quality. Chapter 11, DEQ WQSs. Supplement 08-4. Article 1, WQSs for Surface Waters, Appendix A - Numeric WQSs, Table 1 Domestic Water Source and Agricultural Irrigation Designated Uses.	Relevant and Appropriate	WQSs are established for contaminants under Arizona Administrative Code Title 18, Chapter 11. All public water systems must comply with the levels of contaminants.	None
Soil	RCRA	Federal - RCRA - Criteria for Classification of Solid Waste Disposal and Practices (40 CFR Part 257)	Relevant and Appropriate	Solid wastes containing contaminants greater than the health-based standards established during the completion of the site-specific risk assessment were addressed during removal and remedial activities to meet the goals calculated.	None
Soil	USEPA	Federal - RCRA - Region IX RSLs Table 2012 Update	To be considered	RSLs are generic and based on direct contact exposures which may not address site-specific conditions or indirect exposure pathways.	None
Soil	State	State - RCRA - Title 18, Environmental Quality. Chapter 7, DEQ RA. Supplement 09-1. Article 2, Soil Remediation Standards, Appendix A - Soil Remediation Levels.	Relevant and Appropriate	Solid wastes containing contaminants greater than the health-based standards established during the completion of the site-specific risk assessment were addressed during removal and remedial activities to meet the goals calculated.	None

**Table G-2**  
**Groundwater ARARs for Organic Parameters**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Constituent	AWQS <sup>1</sup> (ug/L)	RSLs (ug/L)				MCL (ug/L)
		1996	2000	2004	2012	
1,2-Dibromo-3-chloropropane	0.2	NL	0.0047	0.048	0.00032	0.2
1,2-Dichloroethane	5.0	NL	0.12	0.12	0.15	5.0
1,2-Dichloropropane	5.0	0.16	0.16	0.16	0.38	5.0
Acetone	NE	610	610	5,500	12,000	NE
Benzene	5.0	NL	0.35	0.35	0.39	5.0
Benzoic acid	NE	NL	150,000	150,000	58,000	NE
Diethylhexylphthalate	6.0	NL	4.8	4.8	0.071	6.0
Bromodichloromethane	TTHM <sup>2</sup> (80)	NL	0.18	0.18	0.12	TTHM (80)
Chloroform	TTHM (80)	0.16	0.16	0.17	0.19	TTHM (80)
Dibromochloromethane	TTHM (80)	NL	0.13	0.13	0.15	TTHM (80)
cis-1,2-Dichloroethene	70	61	61	61	28	70
Ethylbenzene	700	NL	1,300	1,300	1.3	700
1,2-Dibromoethane	0.05	NL	0.00076	0.0056	0.0065	0.05
Methyl ethyl ketone	NE	NL	1,900	7,000	4,900	NE
Methylene chloride	5.0	NL	4.3	4.3	9.9	5.0
Tetrachloroethene	5.0	NL	1.1	0.1	9.700	5.0
Toluene	1,000	NL	720	720	860	1,000
TPH - diesel range	NE	NE	NE	NE	NE	NE
TPH - gasoline range	NE	NE	NE	NE	NE	NE
Trichloroethene	5.0	1.6	1.6	0.028	0.44	5.0
Xylenes, total	10,000	1,400	1,400	210	190	10,000

Notes:

<sup>1</sup> More stringent of DWS and AgI standard listed

<sup>2</sup> TTHM standard is exceeded when the sum of these compounds (and bromoform) exceeds 80 ug/L, as a rolling annual average

AgI = Agricultural irrigation

AWQS = Arizona water quality standard

DWS = Domestic water source

MCL = USEPA maximum contaminant level, updated 2009

ug/L = micrograms per liter

NE = Not established

NL = Not located

RSL = USEPA regional screening level; changed from Region IX preliminary remediation goal (PRG) in 2008, updated 2012, based on tapwater

TTHM = Total trihalomethane

USEPA = United States Environmental Protection Agency

**Table G-3**  
**Groundwater ARARs for Inorganic Parameters**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Constituent	AWQS <sup>1</sup> (ug/L)	RSL (ug/L)				MCL (ug/L)
		1996	2000	2004	2012	
Arsenic	10	0.045	0.045	0.045	0.045	10
Barium	2,000	2,600	2,600	2,600	2,900	2,000
Boron	1,000	NL	3,300	7,300	3,100	NE
Chromium	100	NE	NE	NE	NE	100
Copper	1,300	1,400	1,400	1,500	620	1,300
Lead	15	4	NE	NE	NE	15
Nickel	210	730	730	730	NE	NE
Selenium	20	180	180	180	78	50
Zinc	2,100	11,000	11,000	11,000	4,700	NE

Notes:

<sup>1</sup> More stringent of DWS and AgI standard listed

<sup>2</sup> Secondary standard is reported

ug/L = micrograms per liter

AgI = Agricultural irrigation

AWQS = Arizona water quality standard

DWS = Domestic water source

MCL = USEPA maximum contaminant level, updated 2009

NE = Not established

NL = Not located

RSL = USEPA regional screening level; changed from Region IX preliminary remediation goal (PRG) in 2008, updated 2012 for tapwater

USEPA = United States Environmental Protection Agency



**Table G-4**  
**Soil ARARs for Organic Parameters**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Constituent	Arizona SRLs (mg/kg)						USEPA RSLs (mg/kg)							
	1997		2002		2007		1996		2000		2004		2012	
	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial
1,1,2,2-Tetrachloroethane	NL	NL	4.4	11	0.42	9.3	NL	NL	0.38	0.9	0.41	0.93	0.56	2.8
1,1-Dichloroethene	NL	NL	0.36	0.8	120	410	NL	NL	0.054	0.12	120	410	240	1,100
2-Methylnaphthalene	NL	NL	NE	NE	NE	NE	NE	800	NE	190	NE	NE	230	2,200
Acetone	NL	NL	2,100	8,800	14,000	54,000	2,100	8,800	1,600	6,200	14,000	54,000	61,000	630,000
Anthracene	20,000	200,000	20,000	200,000	22,000	240,000	NE	NL	22,000	100,000	22,000	100,000	17,000	170,000
Benzene	0.62	1.4	0.62	1.4	0.65	1.4	1.2	NL	0.65	1.5	0.64	1.4	1.1	5.4
Benz(a)anthracene	6.1	26	6.1	26	0.69	21	0.61	2.6	0.62	2.9	0.62	2.1	0.15	2.1
Benzo(a)pyrene	0.61	2.6	0.61	2.6	0.069	2.1	0.061	0.26	0.062	0.29	0.062	0.21	0.015	0.21
Benzo(b)fluoranthene	6.1	26	6.1	26	0.69	21	0.61	2.6	0.62	2.9	0.62	2.1	0.15	2.1
Benzo(g,h,i)perylene	NL	NL	NE	NE	NE	NE	NE	NL	NE	NE	NE	NE	NE	NE
Benzo(k)fluoranthene	61	260	61	260	6.9	210	6.1	26	0.61	29	0.38	1.3	1.5	21
Benzoic acid	NE	NE	260,000	1,000,000	240,000	1,000,000	NL	NL	10,000	10,000	100,000	100,000	240,000	2,500,000
Bis(2-ethylhexyl)phthalate	320	1,400	320	1,400	39	1,200	32	140	35	180	35	120	35	120
Butylbenzylphthalate	NL	NL	13,000	140,000	12,000	120,000	NL	NL	12,000	100,000	12,000	100,000	260	910
Carbon disulfide	NL	NL	7.5	24	360	720	NL	NL	360	720	360	720	820	3,700
Chrysene	610	2,600	610	2,600	68	2,000	6.1	7.2	6.1	290	62	290	15	210
Di-n-butyl phthalate	2,600	27,000	NE	NE	6,100	62,000	NL	NL	6,100	88,000	6,100	62,000	6,100	62,000
Ethylbenzene	1,500	2,700	1,500	2,700	400	400	230	NL	230	230	400	400	5.4	27
Fluoranthene	2,600	27,000	2,600	27,000	2,300	22,000	2,600	30,000	2,300	30,000	2,300	22,000	2,300	22,000
Indeno(1,2,3-cd)pyrene	NL	NL	6.1	26	0.69	21	0.61	2.6	0.62	2.9	0.62	2.1	0.15	2.1
Methylene chloride	NL	NL	77	180	9.3	210	NL	NL	8.9	21	9.1	21	56	960
Naphthalene	2,600	27,000	2,600	27,000	56	190	2,400	2,400	56	190	56	190	3.6	18
Phenanthrene	NE	NE	NE	NE	NE	NE	NE	NE	NE	54,000	NE	NE	NE	NE
Polychlorinated biphenyls	2.5	13	2.5	13	0.25	7.4	0.066	NL	0.22	1.0	0.22	0.74	0.14	0.54
Pyrene	2,000	20,000	2,000	20,000	2,300	29,000	100	100	2,300	54,000	2,300	29,000	1,700	17,000
Tetrachloroethene	NL	NL	53	170	0.51	13	NL	NL	5.7	19	0.48	1.3	22	110.0
Toluene	790	2,700	790	2,700	650	650	790	NL	520	520	520	520	5,000	45,000
Total petroleum hydrocarbons	4,100	18,000	NE	NE	NE	NE	NL	NL	NE	NE	NE	NE	NE	NE
Total recoverable petroleum hydrocarbons	4,100	18,000	NE	NE	NE	NE	NL	NL	NE	NE	NE	NE	NE	NE
Trichloroethene	NL	NL	27	70	3.0	65	3.2	7.0	2.8	6.1	0.053	0.11	0.91	6.4
Xylenes, total	2,800	2,800	2,800	2,800	270	420	320	320	210	210	270	420	630	2,700

Notes:

SRLs = ADEQ Soil Remediation Levels

USEPA regional screening levels (RSLs) were changed from USEPA Region IX preliminary remediation goal (PRGs) in 2008, updated in 2012

mg/kg = milligrams per kilogram

NE = Not established

NL = Not located

USEPA = United States Environmental Protection Agency

n-Hexane is used as a surrogate for total petroleum hydrocarbons (TPH) and total recoverable petroleum hydrocarbons (TRPH)

**Table G-5**  
**Soil ARARs for Inorganic Parameters**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Constituent	Arizona SRLs (mg/kg)						USEPA RSLs (mg/kg)							
	1997		2002		2007		1996		2000		2004		2012	
	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial	Residential	Industrial
Antimony	31.0	680.0	31	680	31	410	31	680	31	820	31	410	31	410
Arsenic	10	10	10	10	10	10	0.38	2.4	0.39	2.7	0.39	1.6	0.39	1.6
Barium	NL	NL	5,300	110,000	15,000	170,000	5,300	100,000	5,400	100,000	5,400	67,000	15,000	190,000
Beryllium	1.4	11	1.4	11	150	1,900	0.14	1.1	150	2,200	150	1,900	160	2,000
Cadmium	38	850	38	850	39	510	38	NL	9.0	810	37	450	70	800
Chromium	2,100	4,500	2,100	4,500	2,100	4,500	210	450	210	450	210	450	NE	NE
Copper	2,800	63,000	2,800	63,000	3,100	41,000	2,800	63,000	2,900	76,000	3,100	41,000	3,100	41,000
Lead	400	2,000	400	2,000	400	800	400	NL	400	750	400	800	400	800
Mercury	NL	NL	6.7	180	23	310	23.0	NL	23	610	23	310	10	43
Nickel	NL	NL	1,500	34,000	1,600	20,000	1,500	34,000	1,600	41,000	1,600	20,000	NE	NE
Selenium	NL	NL	380	8,500	390	5,100	380	8,500	390	10,000	390	5,100	390	5,100
Silver	NL	NL	380	8,500	390	5,100	380	8,500	390	10,000	390	5,100	390	5,100
Thallium	NL	NL	NE	NE	5.2	67	NL	NL	5.2	130	5.2	67	0.78	10
Zinc	NL	NL	23,000	510,000	23,000	310,000	23,000	100,000	23,000	100,000	23,000	100,000	23,000	310,000
Cyanide	NE	NE	1,300	14,000	1,200	12,000	NL	NL	11	35	1,200	12,000	47	610

Notes:

SRLs = ADEQ Soil Remediation Levels

USEPA regional screening levels (RSLs) were changed from USEPA Region IX preliminary remediation goal (PRGs) in 2008, updated 2012

mg/kg = milligrams per kilogram

NE = Not established

NL = Not located

USEPA = United States Environmental Protection Agency

**Table G-6**  
**Summary of Toxicity Values**  
**Third Five-Year Review Report**  
**Luke Air Force Base**

Constituent	Baseline Basewide Risk Assessment (1997)				Current	
	RfD (mg/kg/day)		CSF	Oral Efficiency	RfD (mg/kg/day)	CSF
	Subchronic	Chronic				
Volatile Organic Compounds						
Bromodichloromethane	0.02	0.02	0.062	1.0	0.02 (3/1991)	0.0062 (3/1993)
Bromoform	0.2	0.02	0.0079	1.0	0.02 (3/1991)	0.0079 (3/1993)
Chloroform	0.01	0.01	0.0061	1.0	0.01 (10/2001)	NA (10/2001)
Dibromochloromethane	0.2	0.02	0.084	1.0	0.02 (3/1991)	0.084 (1/1992)
1,2-Dichloropropane	0.0037	0.0011	0.068	1.0	0.004 (12/1991)	NA (1/1991)
1,1-Dichloroethene	--	--	--	--	0.005 (8/2002)	NA (8/2002)
1,1,2,2-Tetrachloroethane	--	--	--	--	0.05 (9/2010)	0.2 (9/2010)
Semivolatile Organic Compounds						
Benzo(a)anthracene	0.3	0.03	0.73	0.85	0.03 (7/1993)	NA (1/1991)
Benzo(b)fluoranthene	0.3	0.03	0.73	0.85	0.03 (7/1993)	NA (1/1991)
Benzo(a)pyrene	0.3	0.03	7.3	0.85	0.03 (7/1993)	NA (1/1991)
Dibenz(a,h)anthracene	0.3	0.03	7.3	0.85	0.03 (7/1993)	NA (1/1991)
PCBs	0.00005	0.00002	7.7	0.95	0.00002 - 0.00007 (11/1996)	NA (6/1997)
TRPH	0.6	0.06	NA	1.0	0.7 (12/2005)	NA (12/2005)
Metals						
Antimony	0.0004	0.0004	NA	0.01	0.0004 (2/1991)	NA
Arsenic	0.0003	0.0003	1.5	0.95	0.0003 (2/1993)	1.5 (4/1998)
Beryllium	0.005	0.005	4.3	0.009	0.002 (4/1998)	NA (4/1998)
Cadmium	0.0005	0.0005	NA	0.02	0.0005 (2/1994)	NA (6/1992)
Chromium, hexavalent	0.02	0.005	NA	0.02	0.003 (9/1998)	NA (9/1998)
Copper	0.037	0.037	NA	0.6	NA	NA
Lead	NA	NA	NA	0.15	NA (7/2004)	NA (7/2004)

Notes:

Baseline Basewide Risk Assessment toxicity values were sourced from Appendix B, Table E-5, Final Remedial Investigation Report, Volumes I and II (Geraghty & Miller, 1997)

Current toxicity values were sourced from USEPA's Integrated Risk Information System (IRIS) web site and the latest revision date is presented in parentheses

RfD = reference dose

CSF = cancer slope factor

mg/kg/day = milligram (compound) per kilogram (body weight) per day

NA = Not available or not applicable; "--" = Not included in Table E-5 of Basewide Risk Assessment

For benzo(a)anthracene, benzo(b)fluorene, benzo(a)pyrene, and dibenz(a,h)anthracene, pyrene was used as a surrogate

For total recoverable petroleum hydrocarbons (TRPH), n-hexane was used as a surrogate

## **Appendix H**

### **Copies of VEMURs**

# Unofficial Document

When recorded mail to:

00-0455841 06/15/00 02:19  
BECKY 5 OF 7

**CAPTION HEADING:**\_\_\_\_\_

**DO NOT REMOVE**

**This is part of the official document.**

# NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S5 has remediated a portion of the above-described property, that remediated portion is described as follows: T2N, R1W, S5 (PSC DP-13); a drainage ditch that was thought to have been used for general refuse disposal.

The portion of PSC DP-13, Drainage Ditch Disposal Area, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
928231.64	557919.72	33 33 02.66187	112 22 58.90204
928253.11	558017.37	33 33 02.87867	112 22 57.74925
928155.41	558038.83	33 33 01.91301	112 22 57.49049
928133.97	557941.18	33 33 01.69655	112 22 58.64326

Constituents of Concern are chromium and lead. Wastes collected from Test Pit TY-12 at a depth of 5 feet bgs contained chromium at 15,900 mg/kg and lead at 36,000 mg/kg. Because the wastes are buried and the surface area is maintained, direct exposure is not likely to occur at current land use scenarios. However, exposure to these buried wastes could result if excavation were to occur at certain areas of the site or if the site were developed for residential purposes.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A). Unofficial Document

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

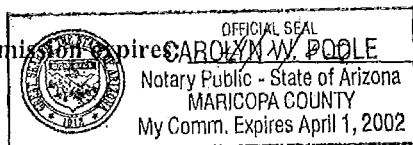
  
(ADEQ official)

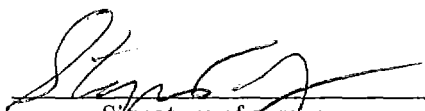
STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this 24<sup>th</sup> day of May, 2000  
by David R. Chavito  
Carolyn W. Poole  
Notary Public

My commission expires



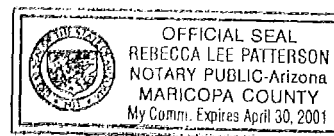
  
Signature of owner

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this 12<sup>th</sup> day of May, 2000  
by Stephen T. Sargeant  
Rebecca Lee Patterson  
Notary Public

My commission expires: 30 April 2001

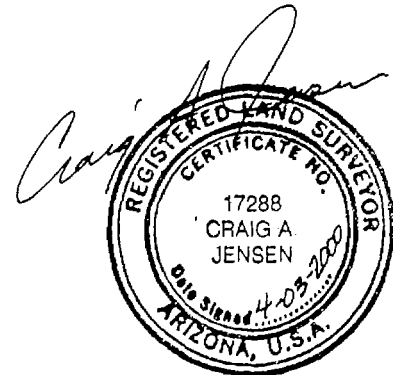


PSC Location Information  
For Use with VEMURS  
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone  
NAD 1983 Datum  
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.  
Using GPS Real Time Kinematic methods  
NGS Control stations used for this survey "Lithchfield" PID #DV2034  
and "Farm" PID #DV2235





# Unofficial Document

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06/15/00

02:19

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6 OF 7

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# NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S5NE quarter has remediated a portion of the above-described property, that remediated portion is described as follows T2N, R1W, S5NE quarter (PSC FT-07E); three fire training pits where POL waste was used.

The portion of PSC FT-07E, the Eastern Portion of North Fire Training Pit, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
927655.96	559904.62	33 32 57.05395	112 22 35.41772
927655.97	560404.58	33 32 57.07601	112 22 29.51024
926995.95	560404.54	33 32 50.54591	112 22 29.47623
926995.93	559904.60	33 32 50.52387	112 22 35.38345

Constituents of Concern are TRPH. Although COC were not present at concentrations high enough to cause adverse health effects under current land use scenarios (military/industrial), remedial alternatives were developed as a protective measure should residential scenarios be considered.

The date when the remediation was complete is: Dec 1992.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

Unofficial Document

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

Jim Epel  
(ADEQ official)

Stephen T. Sargeant  
Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

County of Maricopa

County of Maricopa

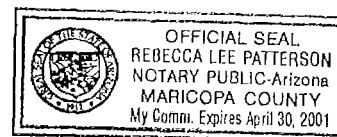
This instrument was acknowledged before me this 24<sup>th</sup> day of May, 2000

by Carolyn W. Poole  
Notary Public  
My commission expires: 4/1/02

This instrument was acknowledged before me this 12<sup>th</sup> day of May, 2000

by Stephen T. Sargeant  
Notary Public

My commission expires: 30 April 2001

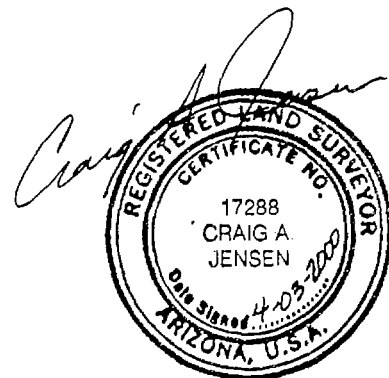


PSC Location Information  
For Use with VEMURS  
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone  
NAD 1983 Datum  
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.  
Using GPS Real Time Kinematic methods  
NGS Control stations used for this survey "Lithchfield" PID #DV2034  
and "Farm" PID #DV2235



# Unofficial Document

When recorded mail to:

BEILE MATTHEWS  
56 CES/CEUR  
13970 W. Lightning St  
LUKE AFB AZ 85309  
-1149



M/

00-

BECKY

1 OF 2

**CAPTION HEADING:**\_\_\_\_\_

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# NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 4 SE quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 4 SE quarter (PSC LF - 03); an oil/water separator that seeped contaminants into the ground.

The portion of PSC LF-03, Outboard Runway Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
924204.27	557788.56	33 32 22.81036	112 23 00.23760
924204.27	558288.57	33 32 22.83259	112 22 54.33013
922704.25	558288.59	33 32 07.99184	112 22 54.25045
922704.25	557788.58	33 32 07.96962	112 23 00.15764

Constituents of Concern are chromium. Samples of the wastes collected from Test Pit TP-5 at depths of 8 foot bgs and a 7-8 foot bgs contained chromium at concentrations of 349 and 386 mg/kg. Because the metallic wastes containing elevated concentrations of chromium are buried and extend below the outboard runway, direct exposure is not likely under current land use scenarios. Long term exposure to these buried wastes could result if the runways were removed and the site was developed for residential purposes.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

(ADEQ official)

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this

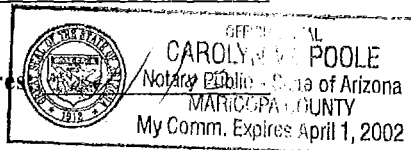
24th day of May, 2000

by David M. Baposta

Carolyn H. Poole

Notary Public

My commission expires



Signature of owner

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this

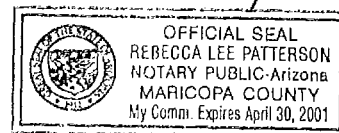
12th day of May, 2000

by Stephen T. Sargeant

Rebecca Lee Patterson

Notary Public

My commission expires: 30 April 2001



PSC Location Information  
For Use with VEMURS  
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone  
NAD 1983 Datum  
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.  
Using GPS Real Time Kinematic methods  
NGS Control stations used for this survey "Lithchfield" PID #DV2034  
and "Farm" PID #DV2235



# Unofficial Document

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HELEN PURCELL

00-0455840 06/15/00 02:19

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4 OF 7

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# NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 4 NE quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 4 NE quarter (PSC LF-14); an old landfill where PCB-container transformer fluids may have been placed.

The portion of PSC LF-14, Old Salvage Yard Burial Site, to be included in the VEMUR is that property lying within the boundary denoted by the following points:  
Location of PSC LF-14

Northing	Easting	Latitude	Longitude
928384.04	564227.42	33 33 04.44425	112 21 44.37635
928259.92	565225.31	33 33 03.25843	112 21 32.57864
927923.37	565227.01	33 32 59.92883	112 21 32.54168
927923.37	565127.00	33 32 59.92461	112 21 33.72332
928290.99	564915.28	33 33 03.55277	112 21 36.24371
928300.96	564227.43	33 33 03.62219	112 21 44.37206
928363.57	565124.48	33 33 04.27968	112 21 33.77532

Constituents of Concern are PCBs. Concentration of PCB were detected at 2,300 mg/kg at a depth greater than 16 feet bgs.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

Unofficial Document

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

*[Signature]*  
(ADEQ official)

*[Signature]*  
Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

County of Maricopa

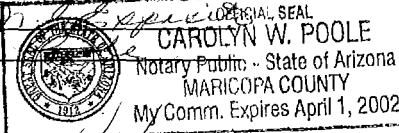
County of Maricopa

This instrument was acknowledged before me this 24th day of May, 2000

This instrument was acknowledged before me this 12th day of May, 2000

by Carolyn W. Poole  
Notary Public

by Stephen T. Sargeant  
Notary Public



My commission expires: 4/1/02

My commission expires: 30 April 2001

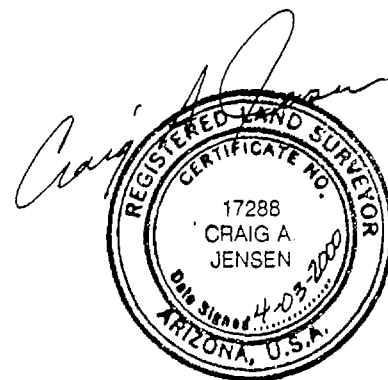


PSC Location Information  
For Use with VEMURS  
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.30	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone  
NAD 1983 Datum  
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.  
Using GPS Real Time Kinematic methods  
NGS Control stations used for this survey "Litchfield" PID #DV2034  
and "Farm" PID #DV2235



# Unofficial Document

When recorded mail to:

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2 OF 7

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**NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION  
USE RESTRICTION BY OWNERS**

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 4 SE quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 4 SE quarter (PSC LF - 25 Skeet Range);

The portion of PSC LF-25, the Northwest Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
918337.72	552234.71	33 31 24.51630	112 24 05.53072
919802.79	553585.30	33 31 39.07344	112 23 49.65696
919531.71	553879.36	33 31 36.40492	112 23 46.16850
918066.64	552528.79	33 31 21.84790	112 24 02.04189

Contaminants of concern were lead and antimony.

The date when the remediation was complete is: 20 Dec 1999.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

Unofficial Document

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

Jim Enul  
(ADEQ official)

Stephen T. Sargeant  
Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

County of Maricopa

County of Maricopa

This instrument was acknowledged before me this 24<sup>th</sup> day of March, 2000  
by David G. S. S. S. S.

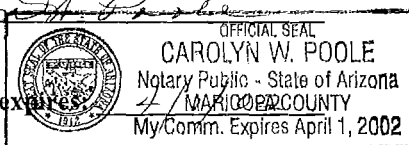
This instrument was acknowledged before me this 12<sup>th</sup> day of May, 2000  
by Stephen T. Sargeant

Notary Public

Notary Public

My commission expires

My commission expires: 30 April 2001



PSC Location Information  
For Use with VEMURS  
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 26.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone  
NAD 1983 Datum  
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.  
Using GPS Real Time Kinematic methods  
NGS Control stations used for this survey "Lithchfield" PID #DV2034  
and "Farm" PID #DV2235



# Unofficial Document

When recorded mail to:

00-0455839 06/15/00 02:19  
BECKY 3 OF 7

**CAPTION HEADING:**\_\_\_\_\_

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**NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION  
USE RESTRICTION BY OWNERS**

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 1 SW quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 1 SW quarter (PSC RW-02); a former base landfill for the disposal of refuse and a small quantity of low-level radioactive electron tubes and dials.

The portion of PSC RW-02, Wastewater Treatment Annex Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points: The portion of PSC RW-02, Wastewater Treatment Annex Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
924067.08	576120.61	33 32 22.21683	112 19 23.64194
924067.76	576148.57	33 32 22.22457	112 19 23.31171
924027.62	576149.44	33 32 21.82752	112 19 23.29953
924026.58	576119.61	33 32 21.81604	112 19 23.65195

Constituents of Concern are unclassified low-level radioactive waste consisting of low-level radioactive tubes and dials that were buried at the site in 1956. The radioactive material was encased in concrete and was disposed of in a pit 12 feet deep with 4 feet of concrete cover and 6 feet of earth cover.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

Unofficial Document

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

  
(ADEQ official)

  
Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

County of Maricopa

County of Maricopa

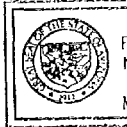
This instrument was acknowledged before me this 24<sup>th</sup> day of May, 2000

by David J. Barger

Notary Public  **CAROLYN W. POOLE**  
Notary Public - State of Arizona  
MARICOPA COUNTY  
My Comm. Expires April 1, 2002

My commission expires: April 1, 2002

This instrument was acknowledged before me this 12<sup>th</sup> day of May, 2000

by Stephen T. Barger  
Notary Public  **REBECCA LEE PATTERSON**  
NOTARY PUBLIC - Arizona  
MARICOPA COUNTY  
My Comm. Expires April 30, 2001

My commission expires: 30 April 2001

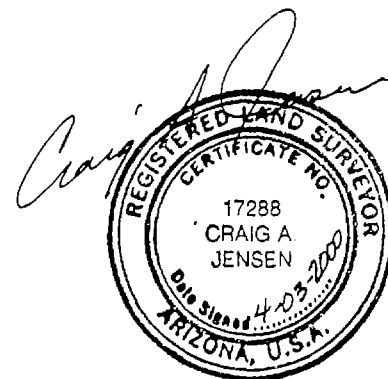


PSC Location Information  
For Use with VEMURS  
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
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	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone  
NAD 1983 Datum  
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.  
Using GPS Real Time Kinematic methods  
NGS Control stations used for this survey "Lithchfield" PID #DV2034  
and "Farm" PID #DV2235



# Unofficial Document

When recorded mail to:

BELLE MATTHEWS  
56 CES/CEUR  
13970 W. LIGHTNING ST.  
LUKE AFB AZ  
85309-1149

00-0455843

06/15/00

02:19

BECKY

7 OF 7

**CAPTION HEADING:**\_\_\_\_\_

**DO NOT REMOVE**

**This is part of the official document.**

# NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S 5 has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S 5 (PSC SD-38); an oil/water separator located at the Auto Hobby Shop that seeped contaminants into the ground.

The northing and easting information was converted to latitude and longitude using NAD 83 Geographic horizontal data.

The portion of PSC SD-38, Oil /Water Separator located at the Auto Hobby Shop, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
925083.77	564394.52	33 32 31.79928	112 21 42.23444
925086.23	564459.55	33 32 31.82639	112 21 41.46624
925054.43	564459.55	33 32 31.51181	112 21 41.46462
925052.32	564394.52	33 32 31.48816	112 21 42.23284

Constituents of Concern are TRPH where the highest concentration was 58,000 mg/kg in the sample collected directly below the former separator at a depth of 8 feet bgs. The deepest detection of TRPH was at a depth of 256 feet bgs at 90 mg/kg.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September, 1999.

Unofficial Document

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

*Jim Egan*  
(ADEQ official)

*Stephen T. Sargeant*  
Signature of owner

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this

24th day of May, 2000

by Carolyn W. Poole  
Notary Public



My commission expires: April 1, 2002

STATE OF ARIZONA

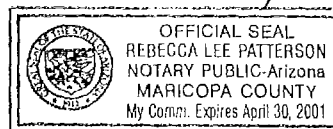
County of Maricopa

This instrument was acknowledged before me this

12th day of May, 2000

by Stephen T. Sargeant  
Notary Public

My commission expires: 30 April 2001

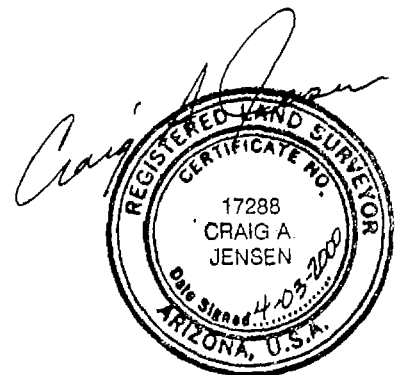


PSC Location Information  
For Use with VEMURS  
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
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	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
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	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
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	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone  
NAD 1983 Datum  
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.  
Using GPS Real Time Kinematic methods  
NGS Control stations used for this survey "Litchfield" PID #DV2034  
and "Farm" PID #DV2235



## **Appendix I**

### **Draft Third Five-Year Review Report Response to USEPA and ADEQ Comments Letters**



DEPARTMENT OF THE AIR FORCE  
AIR EDUCATION AND TRAINING COMMAND

14 May 2012

Mr. Alan C. Thomas, PE  
56 CES/CEAN  
13970 Gillespie Drive  
Luke Air Force Base, Arizona 85309

Mr. Travis Barnum  
Arizona Department of Environmental Quality  
Federal Projects Unit  
1110 West Washington  
Phoenix, Arizona 85007

Re: Response to ADEQ Comments on Draft Third Five-Year Review Report, Luke Air Force Base, Arizona, February 2012

Dear Mr. Barnum:

Thank you for your thoughtful comments on the draft Third Five-Year Review Report, Luke Air Force Base, Arizona, prepared by Stell Environmental Enterprises and ARCADIS (your letter dated 16 April 2012). We are also sending this letter to Ms. Xuan-Mai Tran at EPA Region 9.

For ease of reference, your comments (C) have been italicized, followed by our response (R).

**General Comments:**

*C1. ST-18 cap: cracks keep occurring, and repairs are ongoing. Analysis may need to be made to determine maintenance versus replacement of cap over the next five year review.*

R1. While we believe that our current repair strategy is a conservative approach, during the next five year review period we will complete a formal analysis to evaluate the costs and benefits of continued maintenance vs. replacement of the concrete cap at ST-18. The evaluation will be performed by a third-party consultant with specific expertise in concrete slabs. We will apply for funding for this work in fiscal year 2013, and assuming funding is available, expect to perform the analysis in 2014. We will include ADEQ and EPA in the process.

*C2. Gamma radiation harmful levels and conversion of Geiger count to medically-relevant level should be discussed.*

R2. Gamma radiation levels at RW-02 are being measured by a Ludlum scintillation counter using a Ludlum 44-10 probe, which reads in counts per minute (cpm), calibrated vs. a Cesium



137 source. The average readings at RW-02 over the past 10 years have been in the range of 13,000 cpm. Ludlum's published conversion rate for this probe, assuming Cesium 137 as a source, is 900 cpm per microRoentgen per hour ( $\mu\text{R/hr}$ ). This translates to a measured exposure rate of about 14.5 $\mu\text{R/hr}$  at RW-02. This level is well within the published range of background radiation exposure expected in this region and does not indicate any measurable increase due to the material entombed at RW-02. To put it most simply, at this rate of exposure, a worker could stand still in this spot around the clock all year, if there were some compelling reason to do so, and would not exceed occupational exposure limits in the process.

We will revise the report text to make clearer, and also will revise the graphs illustrating the results of radiation monitoring, included as Appendix C of the Five-Year Review Report, to make this point. We will send you this revised graph for discussion and comment under separate cover.

Although we are convinced that the concrete tomb remains intact and protective, it is questionable whether this remedy is the most efficient use of resources. During the next Five-Year Review period, we plan to conduct a formal review of the costs and benefits of retaining the current remedy vs. excavation, transportation and off-site disposal at a permitted low-level radioactive waste facility. We will include ADEQ and EPA in the process from the beginning.

#### **Specific Comments**

C1. *Signatory Page should read as:*

*Tina LePage, Section Manager  
Remedial Projects Section  
Arizona Department of Environmental Quality*

R1. Signature block has been updated.

C2. *Table of Contents (TOC)*

*Please include the preceeding pages*

<i>REPORT CERTIFICATION AND APPROVALS.....</i>	<i>i</i>
<i>ACRONYMS AND ABBREVIATIONS.....</i>	<i>v</i>
<i>EXECUTIVE SUMMARY.....</i>	<i>1</i>
<i>FIVE YEAR SUMMARY FORM.....</i>	<i>2</i>
<i>INTRODUCTIONS.....</i>	<i>4</i>

R2. The Table of Contents has been updated to include these elements.

C3. *Tables – It would be helpful to list the section or page number to reference the location of the table in the document.*

R3. The Table of Contents has been updated to include pages numbers for the figures and tables.

C4. *Tables 1, 2 & 20 – The TOC Table title does not match the title in the document.*

R4. The Table of Contents has been updated with the correct titles of tables.



*C5. Tables 4, 7, 8, 9, 10, 11, 12, 13, and 15 are split between 2 pages – the second page of the table should include “cont.” (see Table 18 – correct).*

R5. These tables have been updated so that the second page of the table includes “cont.” in the title.

*C6. Table 15 – Screening level needs specific reference with date of reference.*

R6. Table 15 has been updated to include footnotes that reference applicable screening levels and dates.

*C7. Table 18 – Capitalize “since” in the TOC*

R7. Edit has been incorporated into the final document.

*C8. Table 18 – SS-42 what does “1994” mean, and what was the resolution for the increased Nickel?*

R8. In Table 18, the issue for SS-42 has been re-written as “the nickel result for MW-119, collected in 1994, was greater than AWQS”. An additional sample for MW-119 was not collected due to issues with the monitoring well (i.e., MW-119 has collapsed and is no longer a valid sampling point). Samples will be collected and analyzed for nickel at monitoring wells MW-122-S and MW-125R-S during the May 2012 sampling event to verify metals concentrations at SS-42. These results will not be available for inclusion in the Five-Year Review report, but will be addressed in the next annual monitoring report.

*C9. Appendix B, D, & E – The TOC title does not match the title in the document*

R9. The Table of Contents has been updated with the correct titles of appendices.

*C10. Appendix G – Missing cover page for Appendix G Tab*

R10. The cover page for Appendix G will be included in the final document.

*C11. Page 35, Section 5.2.5, second sentence, it is unclear the location and history of the skeet range, the text states “surface soils were removed from a 375-foot square area adjacent to the skeet range”, this document does not provide information on a skeet range, please provide additional information for reference. Also Appendix A shows a picture of skeet debris in LF-25 area, skeet are known to contain Polycyclic Aromatic Hydrocarbons (PAHs) which is a listed toxic substance, please explain.*

R11. The location of the Base Skeet Shooting Range will be identified in Figure 7. PAHs were analyzed at LF-25 during the Remedial Investigation (RI) and discussed in the Baseline Risk Assessment. At site LF-25, the institutional controls consist of land use restrictions (VEMUR and constraints described in the Base General Plan, BGP) and the use of personal protective

equipment (PPE) required during all future excavation activities at the site. The institutional controls exist to control a worker's exposure during excavation of the site, not to prevent any ongoing impact to surface conditions. The remedy explicitly assumes that operations at the adjacent skeet range will continue to impact surface conditions at LF-25. We believe that these controls are effective in preventing uncontrolled excavation at LF-25, and thus the remedy remains protective. However, we understand the point that the remedy was selected based on an assessment of surface conditions at LF-25 done several years ago, and that a revalidation of these surface conditions may now be in order. We will request funding for a revalidation of these surface conditions during the fiscal 2013 cycle, and assuming funding, hope to reassess these conditions in 2014. We will involve EPA and ADEQ in this process.

*C12. Page 43, Section 7.1.1, last paragraph, second sentence, "will be" is repeated twice.*

R12. Edit has been incorporated into the final document.

*C13. Page 45, Section 7.1.3, last paragraph, second sentence, rewrite sentence "parameter parameters?"*

R13. Section 7.1.3 sentence has been re-written as "Soil samples and inorganic parameters have not been analyzed during this five-year review time period."

*C14. Page 47, Section 8.0, fourth sentence, rewrite sentence "other information has come to light", and try to avoid colloquialisms and idioms. Please apply this throughout the "Technical Assessment" section, Question C.*

R14. The text for Question C was taken verbatim from the USEPA's Comprehensive Five-Year Review Guidance (2001). However, for clarity the question has been re-written as "Has any other information been discovered that could impact the protectiveness of the remedy?"

*C15. Page 47, Section 8.1, last sentence "taks" should read as "task".*

R15. Edit has been incorporated into the final document.

*C16. Page 47, Section 8.1.1, Question B, is there data to support the conclusion that GW is not being impacted?*

R16. Per the Baseline Risk Assessment (1997), no direct exposure pathway was likely to exist for site DP-13 at soils greater than 16 feet below ground surface (bgs). The constituents, observed at DP-13 during the RI including PAHs, TRPH, and several metals, are characterized by limited mobility and strong sorption in soils. Based on these characteristics and the depth of groundwater at Luke AFB, leaching to groundwater was not expected to be a concern.

*C17. Page 54, Section 8.2, last sentence, "OUp-2" should read as "OU-2"*

R17. Edit has been incorporated into the final document.



*C18. Page 55, Section 9.0, second bullet, second sentence, "form" should read as "from"*

R18. Edit has been incorporated into the final document.

*C19. Appendix A, Photos missing for FT-07E, SD-38, ST-18, and SS-42.*

R19. Photographs of site FT-07E, SD-38, ST-18, and SS-42 will be included in Appendix A of the final report.

Again, thank you for your review and comments, which are greatly helpful in ensuring a thorough and practical checkup of our program. If you have any questions, please do not hesitate to contact me at (623) 856-3621, or at [alan1.thomas@luke.af.mil](mailto:alan1.thomas@luke.af.mil).

Sincerely,

A handwritten signature in black ink, appearing to be 'Alan C. Thomas', with a long horizontal stroke extending to the right.

ALAN C. THOMAS, PE, GS-11, DAF  
Restoration Program Manager

CC: Ms. Xuan-Mai Tran, USEPA



DEPARTMENT OF THE AIR FORCE  
AIR EDUCATION AND TRAINING COMMAND

14 May 2012

Mr. Alan C. Thomas, PE  
56 CES/CEAN  
13970 Gillespie Drive  
Luke Air Force Base, Arizona 85309

Ms. Xuan-Mai Tran  
U.S. Environmental Protection Agency – Region 9  
SFD-8-3  
75 Hawthorne Street  
San Francisco, CA 94105

Re: Response to EPA Comments on Draft Third Five-Year Review Report, Luke Air Force Base, Arizona, February 2012

Dear Ms. Tran:

Thank you for your thoughtful comments on the draft Third Five-Year Review Report, Luke Air Force Base, Arizona, prepared by Stell Environmental Enterprises and ARCADIS (your letter dated 16 April 2012). We are also sending this letter to Mr. Travis Barnum at ADEQ.

For ease of reference, your comments (C) have been italicized, followed by our response (R).

**General Comments:**

*C1. From the Draft Third Five-Year Review Report for Luke Air Force Base (the Five-Year review), dated February 2012, it is not clear whether the necessary institutional controls (ICs) are in place to address potential re-contamination at Site LF-25, the Northwest Landfill. At this site, the main remedial effort was directed at soil cleanup of lead and antimony contamination that originated from the adjacent skeet range. The technical assessment states that the remedy is protective (Section 8.1.5). However, Section 3.5 states that "metal shot, containing lead and antimony, still routinely fall on the site because the adjacent Base Skeet Shooting Range is still active". Please revise the text to explain how this issue is being addressed and whether modifications to the Institutional Control Plan (ICP) may be necessary.*

R1. At site LF-25, the institutional controls consist of land use restrictions (VEMUR and constraints described in the Base General Plan, BGP) and the use of personal protective equipment (PPE) required during all future excavation activities at the site. The institutional controls exist to control a worker's exposure during excavation of the site, not to prevent any ongoing impact to surface conditions. The remedy explicitly assumes that operations at the adjacent skeet range will continue to impact surface conditions at LF-25. We believe that these



controls are effective in preventing uncontrolled excavation at LF-25, and thus the remedy remains protective. However, we understand your point that the remedy was selected based on an assessment of surface conditions at LF-25 done several years ago, and that a revalidation of these surface conditions may now be in order. We will request funding for a revalidation of these surface conditions during the fiscal 2013 cycle, and assuming funding, hope to reassess these conditions in 2014. We will involve EPA and ADEQ in this process.

*C2. The interviews conducted for the Five-Year Review (Appendix B) do not address state and local considerations, as specified in Appendix C of the United States Environmental Protection Agency (USEPA) Comprehensive Five-Year Review Guidance (the Five-Year Review Guidance), dated June 2001. The Five-Year Review Guidance indicates that "interviews should be conducted with various individuals or groups, including the operations and maintenance (O&M) site manager, O&M staff, local regulatory authorities and response agencies, community action groups or associations, site neighbors, and other stakeholders" (Page C-3) and lists several categories of information to be obtained during interviews: background information; state and local considerations; construction considerations; and performance, operations and maintenance problems. Please provide documentation of additional interviews discussing any state, local, and community concerns.*

R2. As noted in the Five-Year Review, the Restoration Advisory Board (RAB) that was active during the Remedial Investigation (RI) and the developing the Record of Decisions (RODs) was disbanded after delisting Luke AFB from the National Priorities List. Many of those individuals of the RAB could not now be found for interviews, and there has been very little public interest expressed during this period. We have identified adjacent landholders and are attempting to contact several who might have knowledge and/or interest in the matter. We are also in the process of interviewing selected local government officials and Luke AFB personnel. These efforts are ongoing and will be documented in the report.

*C3. The Five-Year Review does not address changes in toxicity and other contaminant characteristics, as specified on Page E-7 of the Five-Year Review Guidance. The technical assessment indicates that the exposure assumptions developed during the basewide risk assessment have not changed but does not discuss changes in toxicity. The text does not include the date when the basewide risk assessment was conducted, but revisions to toxicity values have occurred as recently as 2011 (e.g., trichloroethene [TCE] toxicity). Please provide a table showing updated risk values based on revised toxicity values and discuss any changes in risk and their potential impact on protectiveness. Additionally, please revise the Five-Year Review to include a reference to the basewide risk assessment.*

R3. The Baseline Risk Assessment was conducted in 1997. This document will be included in Section 7.1.2 Document Review in the draft final report. The text in Section 8.1 Assessment of Site-Specific Remedies will be updated to reflect the changes in toxicity values.

*C4. The Five-Year Review should provide further detail in discussing the maintenance and effectiveness of ICs, flowing guidelines in the Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance (the Guidance Supplement), dated September 13, 2011. For example, the specific concerns raised in Sections*



*2.2 and 3.1 of the Guidance Supplement should be address. Please revise the Five-Year Review to provide further details regarding ICs at the site.*

R4. The institutional controls (ICs) in place at the Base include: restriction of land usage to non-residential purposes, installation and maintenance of perimeter fencing, concrete capping and surface controls, long-term monitoring, and regulation of work practices to include requirements for the use of PPE while excavation work is taking place. The effectiveness of the ICs are monitored through the site inspections and maintaining the land use constraints documented in the ICP. The site-specific sections in the technical assessment will be modified in the draft final report to include additional information about ICs.

*C5. Portions of the Five-Year Review are repetitive. The technical assessment and protectiveness statements should be written for each Operable Unit (OU) rather than for each individual site. Sections pertaining to individual sites should only include information specific to those sites, such as contaminants of concern (COCs), remedial action objectives (ROAs) and the final remedy. Please revise the Five-Year Review to avoid repeating information that applies to the based as a whole.*

R5. We agree that the Five-Year Review does include some repetitive sections; however for the technical assessment and protectiveness sections, the decision was made to parallel the previous sections of the report and discuss the individual sites rather than by OU. The site-specific text will be modified to minimize repetition as much as possible.

*C6. The Five-Year Review discusses revisions that will be made to the ICP but does not indicate when the revised ICP will be completed. Table 20 indicates that the Base General Plan (BGP) is currently in the process of being updated, but the table does not indicate that the ICP is being updated. Please provide a timeframe for revising the ICP.*

R6. Table 20 will be updated in the draft final report to reflect that the BGP will be updated within one year and the ICP will be updated within two years of finalizing the Third Five-Year Review Report.

*C7. Several of the site maps (Figures 3 through 13) include monitoring locations, but monitoring results are not provided. The maps should include the most recent analytical data collected at each site. Please revise the figures to include this information.*

R7. Site maps will be updated to include the 2011 monitoring data in the draft final report.

*C8. A copy of the Voluntary Environmental Mitigation Use Restriction (VEMUR) should be included with the Five-Year Review. Please provide the VEMUR on CD when the final document is submitted.*

R8. Copies of the VEMURs will be included on a CD in the final report.



*C9. The Five-Year Review should be printed double-sided to reduce paper use. When the document is reprinted, please print it double-sided to the extent possible. Please ensure that future documents are printed double-sided.*

R9. Future reports will be printed double-sided.

### **Specific Comments**

*C1. Signature Sheet: Please revise the signature block for EPA as follows:*

*Michael M. Montgomery*

*Assistant Director*

*Federal Facilities and Site Cleanup Branch, Region 9*

*United States Environmental Protection Agency*

R1. The signature block of EPA has been updated in the draft final report.

*C2. Table 10, Chronology of Events at SS-42: Bulk Fuel Storage Area, Page 22; Table 12, Chronology of Events at ST-18: Former Liquid Waste Storage Facility (Facility 993), Page 26; and Table 14, Groundwater Detections Exceeding Screening Levels, Page 30: Table 10 refers to "annual groundwater sampling" at Site SS-42, but the chronology does not list sampling events for 2007 and 2008. Similarly, Table 12 refers to "annual groundwater sampling and cap inspection: at Site ST-18 but does not include sampling/inspection events for 2007 and 2008. The rightmost column in Table 14 also indicates that sampling at each of these sites occurs annually. Please clarify whether these sites were sampled in 2007 and 2008 and if so revise the Five-Year Review to include these data.*

R2. The 2007 concrete cap inspection at ST-18 was actually done and documented in late December 2006. The 2007 radiation monitoring at site RW-02 was not done due to an oversight, as it is typically done simultaneously with the groundwater monitoring, which was not done that year for the reasons described below.

During the Second Five-Year Review Report, it was noted that due to rising groundwater elevation, several monitoring had screen intervals below the water table. Since groundwater samples may not have been representative of site conditions, monitoring was not performed during 2007 while funding for replacement wells was pending. In 2008, new wells with appropriate screen intervals were installed at these sites. Annual groundwater monitoring at sites ST-18, SS-42, SD-20, FT-07E, and RW-02; gamma radiation monitoring (at RW-02); and the cap inspection (at ST-18) were all performed during 2008.

Tables 10, 12, and 14 will be modified in the draft final report to clarify this situation and to include the 2007 cap inspection and the full 2008 monitoring.

*C3. Section 5.2.8, SS-42 Bulk Fuels Storage Area, Page 37, Section 5.2.10, ST-18 Former Waste Storage Facility, Page 38, and Section 5.2.11, DP-23 Old Surface Impoundment West of Facility 993, Page 38: The text in each of these sections states that "internal land use restrictions, as documented in the BGP [Base General Plan], are in place to restrict future land use," but does*



*not indicate what land use restrictions are in place. Please revise the text to specify the land use restrictions in operation at the base.*

R3. The land use restrictions for sites RW-02, LF-03, FT-07E, DP-13, LF-14, LF-25, and SD-38 documented in the BGP are constraints against residential development of these sites. The BGP's constraints against residential development are enforced through standard operating procedures (SOP) that are already in place at Luke AFB. Prior to the beginning of any building project, an Air Force Form 332 must be filed and approved. As part of the approval process for AF Form 332, the BGP is reviewed to determine if any constraints exist. The final approval of any building projects resides with the Chief of Operations who is required to review the BGP and sign all AF Form 332s.

These sections will be modified in the draft final report to describe the land use constraints as prohibitions of residential development.

*C4. Table 18, Activities Since Second Five-Year Review Report, Page 40: Contradictory information is provided regarding whether ICs are part of the remedy at SS-42, the Bulk Fuels Storage Area. The text states that "ICP does not include SS-42; should be added in next revision." However, the 2007 Five-Year Review states that the "Institutional Control Plan should not include PSC SS-42" (Table 9-1, Page 9-3) since "there is no requirement for ICs specified in the remedy for site SS-42" (2007 Five-Year Review Summary Form, Page ES-5). In the current report, land use restrictions are mentioned but not defined (Section 5.2.8). Please revise the current report to clarify whether or not ICs are part of the remedy at SS-42.*

R4. The remedial alternative selected for SS-42 in the OU-1 ROD was performing soil vapor extraction (SVE) followed by monitoring soil and groundwater to confirm the effectiveness of the SVE system and potential migration of contaminants. The ICP describes the same remedies for SS-42. As such, ICs in the form of long-term monitoring are required for SS-42. Table 18 will be modified in the draft final report to clarify that ICs are in place at site SS-42 and are documented in the ICP.

*C5. Table 18, Activities Since Second Five-Year Review Report, Page 41: A definitive timeframe is needed for implementing ICs at DP-23, the Old Surface Impoundment West of Facility 993. The table states that "ICP does not include DP-23; should be added in next revision," suggesting that this issue has not been addressed in the last five years and is being rolled over into the current Five-Year Review. Please propose appropriate action to include DP-23 in the ICP, and include a timeframe for addressing the issues.*

R5. The ICs to be implemented at DP-23 are land use restrictions, prohibiting residential development, documented in the ICP. The ICP will be updated within two years of finalizing the Third Five-Year Review Report. Table 20 will be updated in the draft final report to reflect that the BGP will be updated within one year and the ICP will be updated within two years of finalizing the Third Five-Year Review Report.



*C6. Section 8, Technical Assessment, Pages 47-54: Support is not provided for statements that changes in soil and/or groundwater Applicable or Relevant and Appropriate Requirements (ARARs) do not affect the protectiveness of the remedy. The most direct way to present this information is in a table presenting the ARAR at the time the remedy was adopted alongside the current value of any numerical ARAR. Please revise the Five-Year Review to include a table showing previous and current ARAR values.*

R6. In Appendix G, Tables G-2 through G-5 present groundwater and soil ARARs at the time the RODs were approved and through current revisions. These tables will be modified in the draft final report to clarify the comparison of the older ARARs to the current values.

*C7. Section 8.1.2, FT-07E Eastern Portion of North Fire Training Area, Page 48 and Table 16, Summary of Remedial Alternatives for OU-1 and OU-2 PSCs, Page 33: The technical assessment states that "the selected remedy for FT-07E was ICs and long-term groundwater monitoring" (Section 8.1.2), whereas the remedy description indicates that the remedy consists of ICs only (Table 16). Please resolve this discrepancy.*

R7. The selected remedy listed in the ROD for site FT-07E was ICs in the form of a VEMUR and land use constraints documented in the BGP and ICP. During the First Five-Year Review, ADEQ requested that several wells be added to the long-term monitoring program, including MW-118 and MW-123 at FT-07E. Table 16 and Section 8.1.2 will be modified in the draft final report to clarify that the groundwater monitoring was not part of the selected remedy but is performed at ADEQ's request.

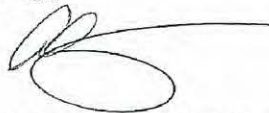
**Minor Comment**

*C1. Appendix G, Table G-3 is up-side down. Please correct it.*

R1. This will be corrected in draft final version of the report.

Again, thank you for your thoughtful review and comments, which are greatly helpful in ensuring a thorough and practical review of our program. If you have any questions, please do not hesitate to contact me at (623) 856-3621, or at [alan1.thomas@luke.af.mil](mailto:alan1.thomas@luke.af.mil).

Sincerely,



ALAN C. THOMAS, PE, GS-11, DAF  
Restoration Program Manager

CC: Mr. Travis Barnum, ADEQ